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FOREIGN TRADE.

The figures given elsewhere in this issue show the continuing and permanent importance of export trade. There is no branch of American industry to-day that is not encouraged and stimulated by the demand for its products abroad, to such an extent indeed, that some adjustment of our fiscal system to meet the cry for cheaper raw materials may soon be necessary. It is generally seen that the more we can export of the things other nations need, the more we can profitably import from other countries the things that we like.

The rapid growth of American foreign trade brings with it obligations, and the great demand abroad for many electrical products has laid new duties on the ELECTRICAL WORLD AND ENGINEER. It has been found highly desirable by this journal, with its increasing international relations, to have better representation in Europe, and after a close study of the situation it has selected and sent Mr. A. C. Shaw, its secretary, to England as its European Manager with headquarters in London. It is not altogether to Mr. Shaw's disadvantage that he was born in the British Isles, nor that for many years he has practiced in the United States as an electrical engineer and has become honorably associated with its electrical journalism. For nearly fifteen years Mr. Shaw has been prominently connected with this paper, part of the time in New England and partly in New York in a managerial capacity, so that he takes with him a ripe experience of the conditions as they exist in the electrical field in America. His services are at the command of the many friends of this journal in England and in all parts of the Continent; and it is sincerely hoped and believed that Mr. Shaw's presence on the other side may strengthen and cement the bonds of social and business intercourse.

ELECTRICITY ON CANALS.

When one considers how much time, effort and money have been required to create a good canal system, it is impossible not to entertain a very lively regret on reading that the Erie Railroad people have lately been dumping ashes into the Delaware and Hudson Canal at Lackawaxen, N. J., in order to fill it up for their own purposes, and on the ground that the canal owners have forfeited their franchise by disuse. Without going into the merits of the controversy, we cannot refrain from condemning such action as premature. Just at the present time the prospects of economical canal operation by electricity seem particularly bright. In this country we are about to witness the application of electricity in a novel and ingenious manner to the Erie Canal, where previous attempts have certainly been encouraging; and in Germany the official approval of electricity on the canals has just been announced. It is reported that tests for the Dortmund-Ems Canal, which has been pushed so vigorously by the Emperor himself, have resulted in the adoption of a system employing a hauling electric locomotive on a light track, the inner and outer rails of which form the circuit. The results have been so satisfactory that the government is said to have given out contracts for the equipment of all the canals under its control. The newer methods in this country do not burden the towpath with either overhead wires or live rails, and it is by no means unlikely that many points

of advantage may be found. At any rate, until a fair trial is had of all these methods, to fill up a valuable canal with ashes seems nothing short of criminal. The canals should not be abandoned but revivified by electricity. In these days of commerce and intercommunication we need, not fewer avenues of access, nor all of one kind, but more of many kinds.

THE THIRD RAIL IN NEW YORK.

It is a well-known fact that firemen dread the obstruction and danger of the electric current when engaged in suppressing fires. Years ago, when overhead wires charged with high potential arc lighting currents ramified throughout the large cities, the accidents to firemen were often serious and fatal, but of late years the underground work has reduced the danger to nil, while means have been found readily for cutting trolley circuits around any fire. We are a little surprised, therefore, to note that Fire Chief Croker, of this city, asserts that the third rail on the Manhattan system will menace firemen's lives. It is even more surprising to see Mr. Russell Sage come forward and defend electricity. Saul among the prophets!

As a matter of fact, Chief Croker is misinformed on the subject. He is right to think of the safety of his fine body of men, but it is not true that "there is that third rail charged with electricity to the extent of perhaps thousands of volts." We know of no intention to use such currents on the line, and it may be doubted whether any such plan has ever been even suggested. That is one of the unlikeliest things in the world. What the firemen of Chicago and Liverpool have been able to stand on the electric elevated roads in those cities, without any danger or trouble, the firemen of Greater New York ought to find acceptable. There will be no trouble in looping the circuits on the Elevated around the scene of any fire, and trains will be held up just as they are now under the régime of steam. Moreover, it has been well pointed out that with current available on the line, the elevated along its entire length could be made into an auxiliary fire system with portable powerful pumps driven by motor.

MUNICIPALIZATION IN ILLINOIS.

We have received from the Bureau of Labor Statistics of the State of Illinois a copy of their interesting report just issued and devoted to the private and municipal ownership of public works. Some of the figures it contains are rather surprising, whether accepted or discredited. It appears that there are in Illinois 57 gas plants, under private ownership; 236 electric light and power plants, 197 of which are under private and 39 under municipal ownership, and 165 water works plants, 35 of which are under private and 130 under municipal ownership. To sum up, 458 plants of all kinds are established in 243 of the cities and towns of the state. It is shown that five of the municipal electric light plants have an investment of less than $10,000 each; that ten have from $10,000 to $20,000 invested; five have from $20,000 to $50,000; four from $50,000 to $100,000, and three over $100,000. Of the private plants, six have less than $10,000 each invested; twenty-four have from $10,000 to $20,000; twenty-one from $20,000 to $50,000; four from $50,000 to $100,000, and five over $100,000. The largest of the private plants has an investment of $278,000, but it is obvious that this leaves out Chicago and at least one other city. Briefly stated, 55 per cent. of all the municipal plants and 50 per cent. of all the private plants cost less than $20,000 each; and 74 per cent. of the municipal and 85 per cent. of private plants cost less than $50,000 each.

It is important to observe how a comparison between public and private ownership is reached, although the report disclaims very distinctly any favoritism one way or the other. In a table showing the prices and cost of electric lighting per arc lamp per kw-hour, including rent and taxes, figures are presented for the various plants which show that the ranges are: Highest price asked by private plants, 0.1404; lowest, 0.0521; highest in the case of municipal plants, 0.1848; lowest, 0.0278. The total percentage, however, shows that in the aggregate the average price asked by private plants is 0.0779, while in the case of municipal plants the cost to the citizens is 0.0579, or, including rent and taxes, 0.0624. Considering each group as a whole, the preponderance of evidence is favorable to municipal management; that is to say, the cost of the arc light to the city which produces it is less than the price which the city would have to pay private owners for it, as 5.79 cents or 6.24 cents is less than 7.79 cents.

These conclusions are vitiated, however, by the following table from the report itself:

ITEMS.	PERCENTAGE OF TOTAL COST OF PRODUCTION.			
	Twenty-six municipal plants.	Twenty-six corresponding private plants	All private plants.	The largest municipal plant.
General expenses.....	8.17	14.39	15.46	5.33
Wages.....	33.13	23.60	23.03	41.64
Supplies.....	31.91	29 00	27.87	33.79
Repairs and renewals....	5.19	9.20	8.00	19.24
Depreciation.....	21.60	20.66	21.88	....
Taxes.....	.....	3.15	3.76	....

It will be noted at once that in the case of the largest municipal plant, often claiming absurd low costs, there are no allowances for either depreciation or taxes, while the general expenses evidently exclude interest charges. In the other cases, we are asked to believe that while private plants get their work done for 10 per cent. less, they have nearly twice as much to pay out for repairs and renewals. That there is "a nigger in the fence" goes without saying. One reasonable explanation would be that municipal plants are rapidly deteriorating. There is also the point that the 26 towns where municipal plants are in operation lose the 3.15 per cent. taxes enjoyed by the communities that have encouraged private enterprise, and have not borrowed money at 6 and 7 per cent. to compete in business with their own citizens.

OUTDOING MARCONI.

Not long ago we took occasion to comment on the fact that despite all the talk in this country as to what we could do here in wireless telegraphy, nobody had in any degree approached Mr. Marconi as to his results, even when using apparatus avowedly modeled upon his lines. There are authentic records of work done by Mr. Marconi over scores of miles; and other workers in Europe, like Ducretet and Pasqualini, using his methods, have done work that puts some American dabblers to the blush. Here, for example, in the newspapers of this week, it is announced with a great flourish of trumpets that at Milwaukee two experimenters have actually succeeded in signaling through a suite of seven rooms, as well as through iron and steel safes. Well, what of it? That great scientist, Hertz, did these things so long ago they belong to a past stage of physical discovery; and meantime inventors like Marconi have come forward and shaped into a useful art the control of these etheric vibrations so that we can talk freely without wires through solid mountains and across eighty miles of ocean. These newspaper reports beget fatigue.

THE INVENTION OF THE COHERER.

On another page will be found an article claiming for an Italian savant the invention of the coherer. While the name of Professor Onesti has before been mentioned in this connection, the article referred to lays for the first time, we believe, all the facts before the

public. Mr. Olivetti seems to prove conclusively that Professor Onesti as early as 1884 had discovered and experimented with a coherer practically the same as that described in 1890 by Professor Branly. Moreover, the Italian savant showed that the instrument was affected by action other than that from a current flowing through it as part of a closed circuit. Finally, he made a practical application of the coherer to the detection of seismical movements. As in the case of the great discovery of Pacinnoti, the original publication of Professor Onesti's work was made in an Italian journal, and appears similarly to have escaped the attention of Italian savants as well as that of the rest of the scientific world.

WIRELESS TELEGRAPHY.

The topical discussion last week at the American Institute of Electrical Engineers elicited some interesting particulars in connection with wireless telegraphy. Prof. Fessenden showed, with the aid of a wire skeleton frame, the outlines of an advancing wave train from an excited vertical oscillator, and drew some interesting inferences from the model. While the theory of the wave transmission has already been developed, the many discrepancies which still exist between theoretical deductions and practical results indicate that much additional exact information must be obtained concerning these waves before our knowledge of them can be considered sufficiently reliable to form a sure guide for practical or commercial work.

We may consider, however, that these waves are rapidly dwindling wave-trains of plane polarized light having a relatively very low frequency, i. e., a few millions of cycles per second instead of about half a trillion cycles per second; or, otherwise expressed, of a wave length measured in hectometers instead of in fractions of a micron. The property of these long and invisible light-waves which is their main value and gives them their increasing interest, is their relative immunity from absorption in passing through solid bodies. It seems as though ordinary matter was endowed with opacity to retina-exciting waves of micron length, but was much more transparent to ultra-ultra-violet Röntgen rays on the one side, or infra-infra-red Hertzian rays on the other. Up to the present time our mechanisms for exciting the Hertzian waves are confessedly very crude. We can neither impart very frequent nor very intense electrical vibrations to the oscillator. The rate of dissipation of the oscillator is indeed great, sometimes many kilowatts, even when excited with a comparatively small induction coil, but it is all gone in a twinkling and we cannot keep up the stream of radiation.

The great advantage of a vertical over a horizontal oscillator is the retention of the energy of the wave and its freedom from parasitic reflections of the destructive type set up in the substance of the earth or sea. The magnetic force does not cut the earth with a vertical oscillator, but lies everywhere parallel to the earth. On the other hand, a horizontal oscillator begets waves whose magnetic force pierces the earth as it runs along and seems to induce suicidal eddy-currents in its shell. If the world were made of mercury so as to offer a good conducting surface, it would seem that the waves ejected from a vertical oscillator should be so completely reflected from the metallic surface that they would run on without any dissipation and with but little radial expansion; so that bending over the sphere they would be capable of crossing great distances and exciting responses in "electric-eyes" thousands of miles away. We do not yet know enough to say how far salt water falls short of mercury in its electric image-building properties, but we know that the waves can actuate a coherer at a much greater distance over sea than over land. The trouble with the ground is that it is electrically poor ground, and does not reflect well enough. The running waves sink in and get their feet bogged in the mire, so that the magnetic field carves out eddy currents and the whole ethereal structure melts away. It is stated to have been observed that the earth after rain is sensibly better for the transmission of wireless waves over it than ground that is dry.

The great field of usefulness that we may expect from these unguided electric waves is on the surface of the ocean where wires cannot lie. On land, we have wires enough and waves enough; but to a steamer at sea trying to make a rockbound coast on a foggy night, the advantage of electric invisible Hertzian flashes from lighthouses would be enormous. The same would be true concerning the signals between approaching vessels; for, with the continually increasing speeds of ocean steamers, every improvement in the method of heralding approach, means the saving of much life and treasure. The greater the effective signaling range which can be given to the wireless waves, the greater far is the liability to cross-talk or mutual interference. Until the waves can be emitted in steady rhythmical succession like organ notes instead of harp-twangs, there will be continual difficulty with selective reception. Without selective reception we shall have a babel of polarized light, although directive shielding may be found possible. The useful lighthouse range would be perhaps fifty miles and the useful conversational range on the high seas might well be one hundred. But even such ranges would at present give rise to much confusion in narrow waters and crowded shipping. A grand future for investigation and practical adaptation should lie before this fascinating branch of electro-optics.

ELECTRIC TRACTION FOR STEAM ROADS.

In a contribution to the discussion on a paper on "Electricity versus Steam on Branch Railroad Lines," recently read before the American Society of Civil Engineers, Mr. Charles H. Davis considers the future developments in the use of electric traction not only for steam railway lines, but for new, high-speed interurban transportation systems. All the factors entering are discussed by Mr. Davis, and as his conclusions are based upon a thorough study of the subject, they are of much interest. As to the displacement of steam by electric traction, he concludes that steam roads will not in the near future handle their ordinary freight traffic and long-distance passenger traffic by any other than steam locomotives. Under exceptional conditions of large volume and great density of passenger traffic over small distances, steam roads may, however, handle traffic by electric power, but such cases will be infrequent. On the other hand, in the near future suburban and short-distance interurban passenger traffic and mail, express, baggage and light local freight will be handled by electric power, and this irrespective of whether operating expenses are affected favorably or unfavorably. New railway lines connecting very large centres of population, and where conditions of success are frequent service at much higher speed than can be attained now by steam locomotives, will also be operated by electric motors. It is added that the conditions under which suburban and short-distance interurban traffic will be handled properly by steam roads converting to electric traction are, that the units be light and frequent and operated over comparatively short distances; that the gross receipts be so increased by the change of system as to pay for the increased investment and possibly increased operating expenses; and that where competition of parallel electric roads compels the change, the conversion will be made irrespective of how the operating expenses are affected. While these conclusions may not satisfy the enthusiast who will allow no limitations to the extension of electric traction, they can by no means be considered unfavorable. At any rate, extensions of electric traction to steam roads will in the future proceed in natural order, and come as a result of engineering and traffic studies of each case. The day of the mere special pleader for a system seems to have passed so far as engineering questions are concerned.

American Institute of Electrical Engineers.

The 137th meeting of the Institute was held at 12 West Thirty-first Street on Wednesday evening, November 22. A paper was presented by Edward J. Willis on a "Test of a 300-Kilowatt Direct-Connected Railway Unit at Different Loads." In the absence of the author the paper was read by Prof. Geo. F. Sever. The paper was discussed by Messrs. Hill, Mailloux and Sever.

The subject of "Possibilities of Wireless Telegraphy" was then taken up, the discussion being opened by Prof. R. A. Fessenden, of the University of Western Pennsylvania and continued by W. J. Clarke, M. I. Pupin and others. A meeting of Western members was also held the same time at the Technical Club, Chicago.

At the meeting of Council in the afternoon the following Associate Members were elected: F. C. Baugher, Engineer of Construction, Westinghouse Electric & Manufacturing Company, 120 Broadway, New York; Frank George Baum, Assistant to Chief Engineer, Standard Electric Company of California, San Francisco, Cal.; Louis W. Downes, Vice-President and General Manager, The D. & W. Fuse Company, Providence, R. I.; Clifton V. Edwards, Attorney-at-Law and Solicitor of Patents, 220 Broadway; Geo. H. Gibson, Assistant Editor, *Engineering News*, 220 Broadway; Louis T. Grant, General Manager, The Hilo Electric Light Company, Box 160, Hilo, H. I.; Arthur James Hanson, Lawrence & Hanson, 3 Wynyard Street, residence, Drunnmoyne, Sydney, N. S. W.; Martin J. Insull, Second Vice-President and General Manager, General Incandescent Arc Light Company, New York; E. D. Jackson, Engineer, Youngstown Telephone Company, Youngstown, O.; W. O. Layman, Assistant Manager and Treasurer, Wagner Electric Manufacturing Company, 2017 Jackson Street, St. Louis, Mo.; John Lundie, 52 Broadway, New York City; Chas. William Pendell, Post-Graduate Student, Massachusetts Institute of Technology, 207 West Newton Street, Boston, Mass.; Chas. B. Raub, Electrical Engineer, Engineer Corps, Newport, R. I.; Allen Davidson Roberts, Electrical Inspector, City Council, Kingston, Jamaica; H. A. Russell, Sales Agent General Electric Company, San Francisco, Cal.; Ferdinand Schwedtmann, General Superintendent, Wagner Electric Manufacturing Company, St. Louis, Mo.; Hewlett Scudder, Jr., Assistant to Prof. Henry M. Howe, 21 East Twenty-second Street, New York City; Joseph Suydam Stout, Jr., Inspector, Edison Electric Illuminating Company, New York City; Clinton Eugene Whitney, Draughtsman, 61 West 114th Street, New York City; C. M. Wilkes, Engineer, D. H. Burnham & Company, 1142 The Rookery, Chicago, Ill.

The following Associate Members were transferred to Membership: Cummings C. Chesney, Chief Electrical Engineer, Stanley Electric Manufacturing Company, Pittsfield, Mass.; Capt. Achilles de Khotinsky, late Chief Electrician and Torpedo Officer Imperial Russian Navy, Northern Electric Company, Madison, Wis.

The Statistics of Our Growing Foreign Trade.

The foreign commerce of the United States seems likely to make its highst record of the century in the closing year of that period. The October exports are larger than those of any preceding October, the total for the ten months ending with October is greater than the total for the corresponding period in any preceding year, and it is apparent that for the first time in our history the foreign commerce of the year will exceed $2,000,000,000. For the ten months ending with October, 1899, the figures of the Treasury Bureau of Statistics show the total exports to be $1,029,242,000, while in the corresponding months of last year they were $987,879,000.

This remarkable increase in exportations is the more surprising because of the absence of the excessive demand abroad for our breadstuffs which characterized the year 1898. In that year the short crops abroad and plentiful supplies of breadstuffs of all kinds in the United States resulted in an abnormally large exportation of breadstuffs, so that the exportation of agricultural products in the present year naturally falls about $35,000,000 below that of the corresponding period of last year. Yet the total exportations for the ten months are, as already indicated, more than $40,000,000 in excess of those of last year.

It is easy, however, to find the cause of this remarkable growth in our total exportations which occurs in the face of the reduction in our exportation of breadstuffs. An examination of the detailed figures of the nine months of the year already accessible shows that the exports of manufactures in that period were $50,000,000 in excess of those of the corresponding months of the preceding year, and $65,000,000 greater than those of the same months of 1897, while the products of the mine were $4,000,000 greater than those of the corresponding months of last year, and those of the forest $6,000,000 in excess of the corresponding months of the preceding year. Thus the year's exportation of agricultural productions will be quite up to the normal, while those of manufacture, mining and forestry will exceed those of last year, and, indeed, of any year in our history.

Imports have increased more than exports, for they were unusually low in 1898, while exports were unusually high in that year. The total importation in the ten months ending with October, 1899, is $658,375,000, against $527,734,000 in the corresponding months of last year. This large increase in importations is chiefly in supplies for the manufacturers, whose increased exports are already noted, and in foodstuffs which cannot be produced at home. The increase in importations of material for use of manufacturers, including crude and partially manufactured, was in the nine months ending with September, $50,000,000, a sum just equaling the increase in exportations of manufactures during that time. In foodstuffs, the increase in importations during the nine months was in round terms $38,000,000, of which nearly $30,000,000 was in sugar, the increase in importations of manufactures ready for consumption being $8,000,000, and articles of voluntary use, luxuries, etc., $15,000,000.

The following table shows the imports, exports, and total commerce during the ten months ending with October in each year since 1890, and will indicate the increase in our total foreign commerce which the year 1899, when completed, seems likely to furnish:

Ten months October 31.	Imports.	Exports.	Total Foreign Commerce.
1890	$698,377,317	$670,062,549	$1,368,439,866
1891	693,982,413	740,470,213	1,434,452,626
1892	708,105,559	753,171,018	1,461,276,577
1893	677,060,694	690,907,354	1,367,968,048
1894	563,610,028	660,271,397	1,223,881,425
1895	676,123,483	645,018,438	1,321,141,921
1896	572,555,608	779,578,476	1,352,134,084
1897	638,734,615	857,982,750	1,496,717,365
1898	527,734,608	987,897,010	1,515,631,618
1899	658,375,129	1,029,242,286	1,687,617,415

Cable in the Philippines.

Considerable dissatisfaction is said to be felt by War Department officials at General Otis' conduct with reference to the cable with which it is intended to connect Manila and the military posts in the Philippine archipelago. Although Brigadier General Greely, chief of the Signal Service, began preparations a year ago for laying a cable in the Philippines, the actual work has not yet commenced. The cable ship Hooker, carrying the cable, valued at $90,000, and the cable instruments, valued at $25,000, was wrecked off Corregidor Island last June, and General Otis cabled that she could be saved. A part of the cable was removed, but the remainder and the instruments were allowed to remain in the ship, and it is believed here that the instruments are ruined. After the vessel had lain on the reef for several months General Otis has finally made a contract for raising her. Whether General Otis will place the cable and cable instruments, if the latter are still fit for service, on a transport, and direct that the work of laying the line be commenced, the authorities do not know. The necessity of a military cable in the Philippines is appreciated by the War Department. To the posts this Government has established in the Sulu Islands mail is sent only once a month, unless a transport should be proceeding in their direction, and this delay in communication is often most embarrassing, and would be more so, the department officials say, if the insurrection in Luzon should extend to the Sulus.

Manhattan Elevated.

As we go to press it is reported that the Manhattan Elevated has given its order for electrical apparatus to the Westinghouse Electric & Manufacturing Company, including eight 5000-kw three-phase alternators, 26 rotary converters of 1500-kw each, and 78 stepdown transformers of 550-kw each.

The Plymouth Corporation Electric Works, England.

THE ceremony of opening the Plymouth Corporation Electric Works at Prince Rock, Plymouth, England, and the inauguration of the electric tramways took place Sept. 22. The mayor, corporation and the leading citizens held public holiday, and observed the day with meetings, speeches, and good cheer. Plymouth was the first town in England to be incorporated by act of parliament, and was equally, it is stated, the first city to design an electrical plant combining both lighting and power. Mr. J. Hall Rider was appointed electrical engineer to the corporation in 1896, and has since been industriously employed in designing and carrying out this installation.

The power plant is built on corporation land at Prince Rock, on the Cattewater, the estuary of the river Plym Three Lancashire boilers, rated at 350-hp each, furnish steam. The boilers are run at a pressure of 130 pounds, but are constructed for a working pressure of 160 pounds, to obviate reducing the working pressure as the boilers become old. Welsh coal is delivered by steamer to the wharf alongside the power house, and a branch of the London & Southwestern Railway runs in front of the works, which are thus supplied with ample accommodations both by land and water. Mechanical coking stokers are fitted to each boiler, and a complete system of coal handling arrangements conveys the fuel mechanically from the coal store to the furnaces. An electric motor operates the mechanical stokers. An economizer of 256 tubes has been erected alongside the boilers. Space has been left in the present boiler house for three additional units of the same size. A cast-iron tank holding 28,000 gallons, upon the roof of the coal store, is fed by a three inch pipe from the town mains, the supply of water being paid for at four cents per thousand gallons. Adjacent to the power house there will shortly be constructed a refuse destructor for the town garbage. The electricity committee of the corporation will pay the works committee, who are responsible for the destructor, at the rate of one farthing (one-half cent) per kilowatt hour of electric energy produced. This arrangement will make, it is claimed, a considerable saving in the cost of fuel for the electricity works, and will give over $7500 a year to the credit of the destructor.

The power generating machinery is contained in a building con-

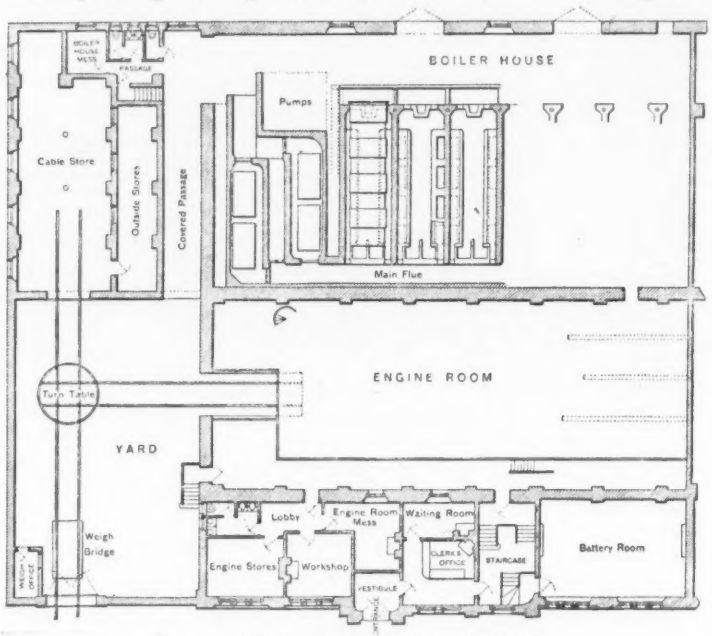


FIG. 1.—GROUND PLAN OF POWER HOUSE.

structed principally of limestone, procured on the site which has been excavated to a considerable depth below the original level, Fig. 1 shows the ground floor plan of the boiler house, engine room, battery room, and the company's offices and other premises. The spacious and lofty machinery room is designed to accommodate more units than are at present erected. The generating station contains both a lighting and power plant, coupled together in a somewhat ingenious manner. The electrical equipment of the tramways was carried out by the Westinghouse Electric Company, Ltd. Fig. 2 shows two sets of generators, each unit consisting of a high speed compound engine of 150-hp and 275 r. p. m., direct coupled by means of a friction clutch to an alternator of 100-kw, and also to a Westinghouse generator of 100-kw, both being on the same side of the steam engine. The engine is capable of driving either the alternator or the generator at full load, or both at half load, or each one in such proportion as the calls for alternating or direct current may require.

A storage battery of 260 Tudor cells is in parallel with the generator. During the day the engine can be run at full load, the alternator supplying whatever small amount of current is required for lighting, and the generator supplying direct current for the tramways. The storage battery, in parallel with the generator, provides for any heavy demand for the tramway service, any current beyond the needs of the tramway line being stored by the battery. By this means a practically constant load is kept upon the engines, and the

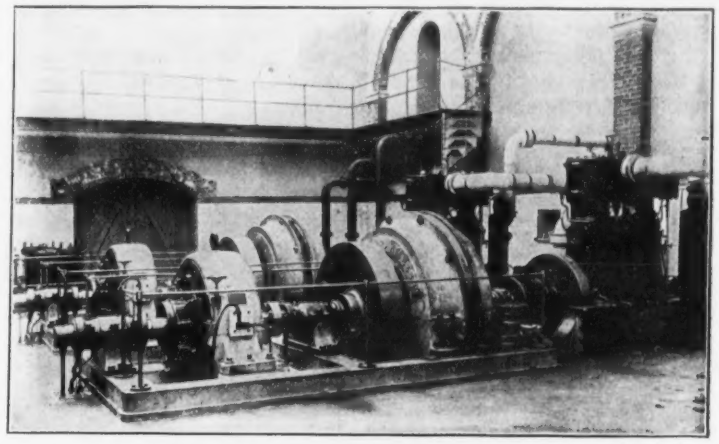


FIG. 2.—100-KW DIRECT CONNECTED GENERATOR AND ALTERNATOR.

cells of the battery are continually being charged, or are discharging according to the demands of the circuit. During the evening the demand for current for lighting purposes naturally increases, and the supply of current for the tramway line is gradually taken off the generator and supplied by the battery, leaving the engine free to drive the alternator at full load for lighting. After midnight, when the lighting circuits are virtually closed and the cars have ceased running, the generator is driven at full load for charging the battery, until six o'clock in the morning, when the cars again commence to run.

The power house also contains two 200-kw alternators, supplying current for lighting, driven at 250 r. p. m., and a 20-kw booster, motor driven, used in series with the direct current generator so that the busbar pressure need not be raised. The booster generator is so arranged that when the demand for current is equal to the output of the generator, the battery will neither charge nor discharge. When the line current is less than the output, the booster will aid in charging the cells. When the line current is greater than the output, the booster will add pressure to the battery circuit and thus help it to discharge.

Between each of the engines and the alternators and Westinghouse generators shown, is a special shaft coupling, so that the engine can be disengaged when desired. The use of the clutch enables the generator and alternator to be used independently of the engine. On Sundays, when no cars run, the generator is operated as a motor from the storage battery, driving the alternator for whatever light load there may be. Similarly the alternator can be run as a synchronous motor from either of the other alternators in the station, and the direct current generator used either for charging the battery or for tramway work, with the battery in parallel. This plant was designed some two years ago, but if it were designed to-day, according to the latest Westinghouse practice in the United States, instead of separate alternators and generators, a combination alternating and direct generator would be employed.

The storage battery consists of 260 Tudor cells, of 600 ampere hours capacity, the maximum discharge rate being 200 amperes. The Tudor Company maintains the battery under guarantee for ten years at a rate of five per cent. on the original cost. The contract stipulates that at any time within twelve hours of being fully charged, the battery must give its full specified capacity of 600 ampere hours without the voltage per cell falling below 1.85 volts.

The power house is equipped with three switchboards for the lighting and power circuits, which are erected on a gallery upon two sides of the machinery room. The alternating current switchboard is of the ordinary pattern, arranged on the single pole principle. The

direct current tramway switchboard is of the usual Westinghouse design, being shown in Fig. 3, and is fitted with the usual instruments for controlling and regulating the current. The regulating resistances are fixed in a room immediately under the switchboard recess.

The length of the tramway lines already opened is 3 1-10 miles, running from the Theatre Royal to Prince Rock, but this is only a part of the projected line. Extensions will be made to Hyde Park, at Mutley, and from the Market Place to Compton, passing through the residential district of Mannamead, and later on further extended to Pounds and Lipson. When these additional lines are completed the present type of combination generators will not be continued, but it is proposed to add a steam driven direct current generator of 500-kw. a battery for 1700 ampere hours at Compton, a 36-kw booster, and a 200-kw motor alternator.

Five different methods of carrying the overhead wires have been employed to suit the character of the road. Owing to the great number of telegraph and telephone wires, guard wires have been used for more than half the route, which rather detracts from the

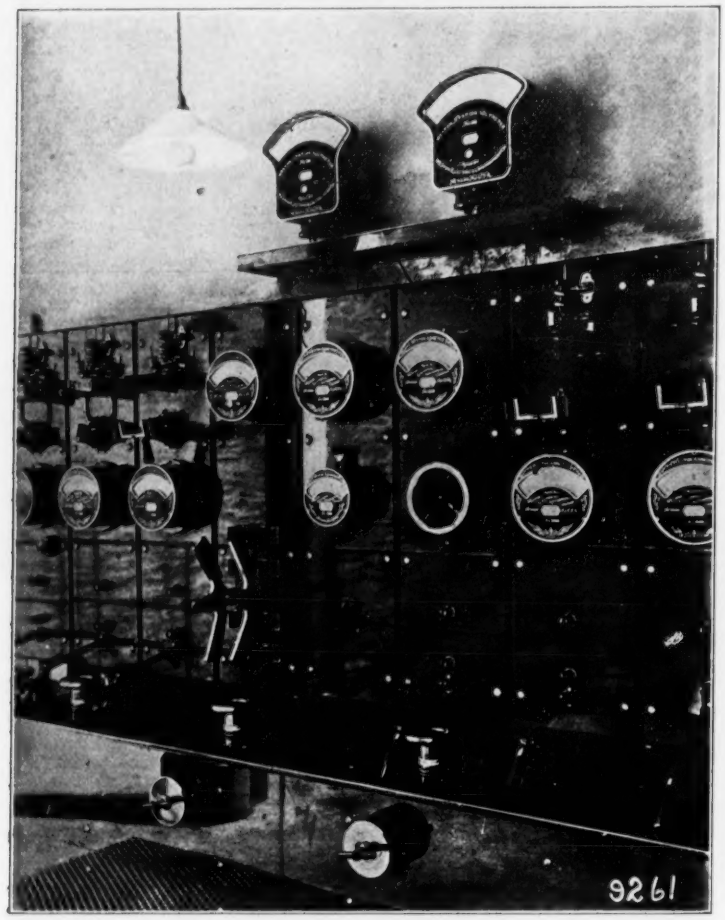


FIG. 3.—SWITCHBOARD.

unusually artistic appearance of the overhead construction. The poles are three-sectional, and at curves the joints are 7 inches, 6 inches and 5 inches diameter. There are a few single tube poles, 8 inches in diameter for half way and then tapering to 6 inches at the top. Arc lamps are fixed on the top of alternate poles in a number of the streets, and where possible on alternate sides of the street, a fiddle-bow suspension, between the ears, holding the wires, has been fitted to avoid oscillation of the lamps. The line is divided into one-half mile sections, according to the English Board of Trade requirements, and insulated in the usual manner. Of the section boxes, two have been very neatly built into the walls of the corporation building. They contain four switch fuses, lightning arrester, telephone, and wire terminals.

The motor cars have seating capacity for twenty inside and twenty-two outside. Each car is fitted with two Westinghouse No. 46 motors, giving 1000 pounds tractive effort, at eight miles an hour. One of the cars is shown in Fig. 4. The controllers are of the Westinghouse series, parallel type, with graded brake. Perfect control is kept over the car by putting the two motors in parallel, and by connecting them by a variable resistance, if necessary, to the extent of short circuiting the motors. This brake has been working very satisfactorily. The tracks are double nearly all the way. The rails are grooved girder section, 92 pounds, thirty feet in length. The future extensions will probably be laid with sixty-foot rails. Each joint is bonded with three No. 000 Chicago bonds, thirty inches long. The tests of the conductivity have given most satisfactory results. Probably no more difficult piece of tramway equipment has yet been completed in England, since the three miles already laid is through tortuous and narrow streets with extremely sharp curves.

The combination of supplying both light and power from the same units, enables the corporation to fix a low price for tractive purposes, and for lighting circuits. In fact, Mr. Rider, the electrical engineer of the Plymouth Corporation, in a speech made at the inaugural ceremony, stated that the prices charged were the lowest that had ever been offered at the opening of any electricity works. The tramway is charged seven cents per kw-hour up to 150,000 units per annum; beyond this figure there will be a reduction in price. The contemplated extensions to tramway lines will necessitate some 600,000 units, the price for which it is estimated will be reduced to 4.6 cents per unit. The prices for lighting for private customers is nine cents per unit, and the same rate has been made for public lighting. The charge for an arc lamp, including cost of cleaning and maintenance, for one year, is $77. According to Mr. Rider, the outlay for electric lighting in Plymouth, is about double that of gas, but he asserts that the former medium gives about twenty times as much illumination as the latter, so that in effect, the public by using electricity obtain ten times as much value for their money. Twenty-one miles of mains have been laid on the three-wire system of distribution, and a large number of houses and stores are being connected up. At the date when the plant was started, connections had been made for 5000 lamps, and applications in hand showed that this number would be increased to 8000 before the end of the winter.

Mr. Alderman Bray in a speech stated that the corporation were determined to extend the application of electricity in Plymouth, as he was convinced that it would be remunerative to the corporation and be a great blessing to the citizens. Comparing the costs of different methods of traction he said that at Leeds the cost of horse traction

FIG. 4.—DOUBLE DECK CAR.

was nearly nineteen cents per mile, steam traction exceeded that cost, while electric traction was less than nine cents.

Wireless Telegraphy From Balloons.

Tests are being made at Vienna on communication between balloons by wireless telegraphy, and, it is stated, they have met with some success. A captive balloon takes the place of the tall mast used by Marconi, and a copper wire is stretched between it and the earth, where the transmitting apparatus is placed. The second balloon, which ascends freely, carries the receiving instrument, and is furnished with a wire 60 feet long, hanging from the basket. This balloon receives messages very well up to a distance of about 10 kilometers (6 miles) and at a height of 1600 meters (about 1 mile). It, however, has been found impossible at present to establish a transmitting station in a free balloon, both on account of the weight of the necessary apparatus, and because of the danger of discharges from a powerful condenser so near the inflammable gas of the balloon.

Electricity in Japan.

No more conclusive evidence of the modern spirit which animates the "Land of the Rising Sun" can be cited than the favor with which electricity has been there received. In electric lighting, aside from stations in a few of the larger cities, the entire development indicated in the accompanying tabulation has taken place within the past few years, and in telephony the present is also a period of great activity. The electric railway has, as yet, not made much headway, but that its day will also soon come is quite certain.

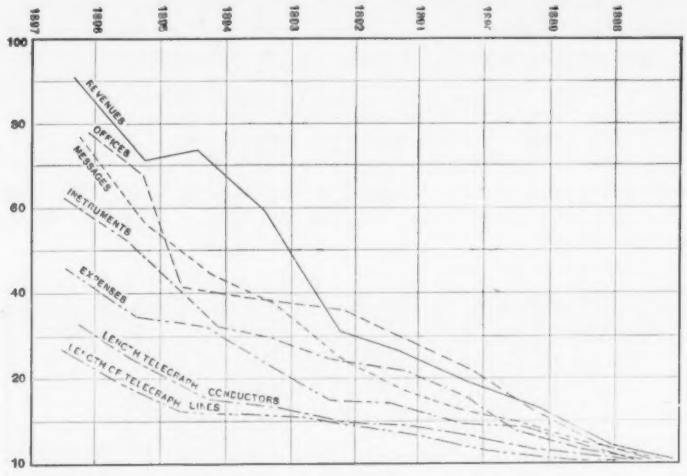


FIG. 1.—CURVES SHOWING GROWTH OF TELEGRAPH SERVICE.

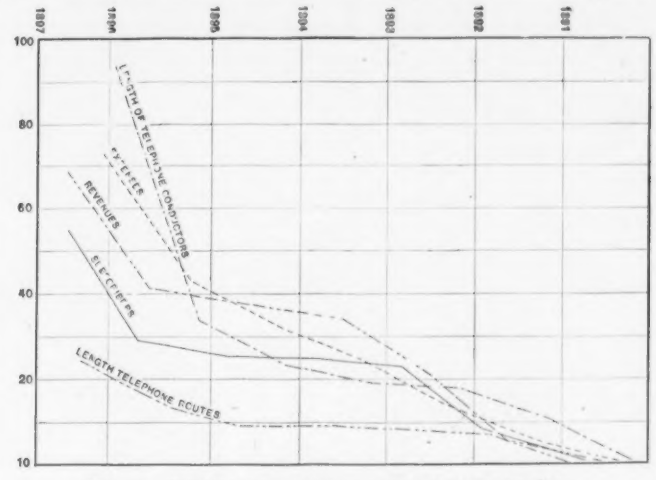


FIG. 2.—CURVES REFERRING TO TELEPHONE SERVICE.

The growth of the telegraph and telephone since 1891 is illustrated by the curves of Fig. 1 and Fig. 2. The government operates both of these services, and out of the profits of the present year, $1,000,000 will be spent on new telephone construction and $1,250,000 on telegraph construction.

Tokyo naturally takes the lead in telephone service. At present there are 4500 telephone subscribers connected and about 4200 applications are on file. The rate charged is $33 a year. One of the accompanying illustrations shows the not unfamiliar sight of installing a telephone cable amid, to us, unfamiliar Oriental surroundings. The number of telephone subscribers in other cities is as follows: Osaka, 1600; Yokohama, 1002; Nagoya, 350; Kyoto, 520; Sakai, 170; Kobe, 843.

The total length of aerial wire in Tokyo is about 900 miles, a great part of which is in the form of 100 and 50 wire cables supplied by the Western Electric company. During the eleven months ended with February, 1899, the number of local calls in Tokyo was 1,399,422. The number of long-distance connections was as follows during the same period: With Osaka, 11,971; with Kyoto, 2211; with Sakai, 562.

An example of one of the small exchanges, that of Nagoya, will be considered in detail. As above stated, there are at present 350 subscribers, and no less than 600 applications are on file. The operators are five in number, and the average number of connections per subscriber per day is 11, the minimum number of connections per operator being 120. The average length of subscribers' lines is 58 miles of metallic circuit, and the charges are $28 per year. The present

STATISTICS OF THE JAPANESE ELECTRIC COMPANIES.

	No. of Generating Station.	No. of Sub-station.	Length of Lines. Ri*	No. of subscribers.	No. of lights, installed. Incand.	Arc.	Power supply. No. subscribers.	H.P.
Tokyo Electric Light Co., Ltd., Minami-moto-machi, Asakusa-ku, Tokyo	1	3	50	4522	45,956	139	2	8
Fukagawa Electric Light Co., Ltd., Kiba-machi, Fukagawa-ku, Tokyo	1	..	10	251	1350	20	..	..
Shinagawa Electric Light Co., Ltd., Shichome, Tamachi, Shibaku, Tokyo	2	..	..	464	5563	5	..	..
Osaka Electric Light Co., Ltd., Gochome, Nakanoshima, Kita-ku, Osaka	3	..	44.6	6992	32,155	107	44	155
Kyoto Electric Light Co., Ltd., Kawaramachi-dori, Shimokyo-ku, Kyoto	2	..	..	..	..	..	..	..
Nagoya Electric Light Co., Ltd., Demma-cho, Nagoya	1	3	33.3	3763	16,360	22	3	42
Yokohama Union Electric Light Co., Ltd., Ichome, Tokiwa-cho, Yokohama	1	..	16.2	1172	16,304	20	..	..
Kobe Electric Light Co., Ltd., Rokuchome, Sakaicho, Kobe	2	..	45.3	1324	10,859	71	..	..
Hiroshima Electric Light Co., Ltd., Shichichome, Otemachi, Hiroshima	2	..	5.5	545	2863	5	..	..
Hiroshima Water Power Co., Ltd., Danbara-mura, Hiroshima	1	2	8.2	..	..	..	..	..
Seudai Electric Light Co., Ltd., Nichome, Omachi, Seudai	2	2	..	420	3214	3	..	..
Nagasaki Electric Light Co., Ltd., Takano-Taira, Nagasaki	1	..	13.2	370	2363	6	..	..
Tokushima Electric Light Co., Ltd., Tera-jima Honmachi, Tokushima	1	..	4.3	657	1764	..	..	..
Hakata Electric Light Co., Ltd., Higashi-nakadsu-machi, Hakata	1	..	2.3	411	2530	..	..	..
Wakayma Electric Light Co., Ltd., Hatayashiki, Wakayama	1	..	3.1	607	1328	1	..	..
Okayama Electric Light Co., Uchisange, Okayama	1	..	11.5	349	1596	..	..	..
Niegata Electric Light Co., Ichome, Hakusan-maye, Niegata	1	1	3.7	143	1036	..	..	..
Sappro Electric Light Co., Sanchome, Odori, Sapporo	1	..	7.1	158	1487	2	..	..
Shidsuoka Electric Light Co., Ltd., Shimo-sakana-machi, Shidsuoka	1	..	2.9	489	1774	1	..	..
Bakan Electric Light Co., Kwan-non-zakimachi, Bakan	1	..	7.1	396	1719	..	..	..
Matsuye Electric Light Co., Ltd., Tono-machi, Matsuye	1	..	1.3	357	1013	..	..	..
Otaru Electric Light Co., Inahomachi, Otaru	1	..	5.2	195	1800	..	..	..
Takamatsu Electric Light Co., Uchi-machi, Takamatsu	1	..	1.6	600	1620	..	..	..
Gifu Electric Light Co., Ltd., Imagawa-machi, Gifu	1	..	2.4	320	960	..	..	..
Yonezawa Electric Light Co., Yanagi-machi, Yonezawa	1	..	12.2	198	744	..	..	..
Tsu Electric Light Co., Ltd., Minami Hori-bata, Tsu	1	..	2.3	383	960	..	..	..
Himeji Electric Light Co., Ltd., Shita-kata-machi, Himeji	1	..	1.5	256	684	..	..	..
Nara Electric Light Co., Ltd., Taka-ten-machi, Nara	1	..	5.0	311	857	6	..	..
Hachi-o-ji Electric Light Co., Hachi-o-ji	1	..	2.6	87	350	..	..	..
Aomori Electric Light Co., Ltd., Tsukurimichi, Aomori	1	..	4.9	271	1510	2	..	..
Yokkaichi Electric Light Co., Kitajo-machi, Yokkaichi	1	..	2.8	295	1269	1	..	..
Onomichi Electric Light Co., Ltd., Osaki-machi, Onomichi	1	1	2.9	345	900	..	..	..
Fukushima Electric Light Co., Fukushima, Fukushima Prefecture	1	1	6.0	332	1113	2	..	..
Okazaki Electric Light Co., Okazaki, Aichi Prefecture	1	..	15.0	550	1620	1	1	..
Wakamatsu Electric Light Co., Ltd., Wakamatsu, Fukuoka Prefecture	1	..	5.7	253	1013	1	..	..
Tosa Electric Light Co., Ltd., Tosa, Kochi Prefecture	1	..	6.0	419	1226	3	..	..

*The Japanese Ri is equal to 2.44 English miles.

switchboard is to be replaced with one of the multiple type. Subscribers are furnished with solid-back transmitters, and overhead

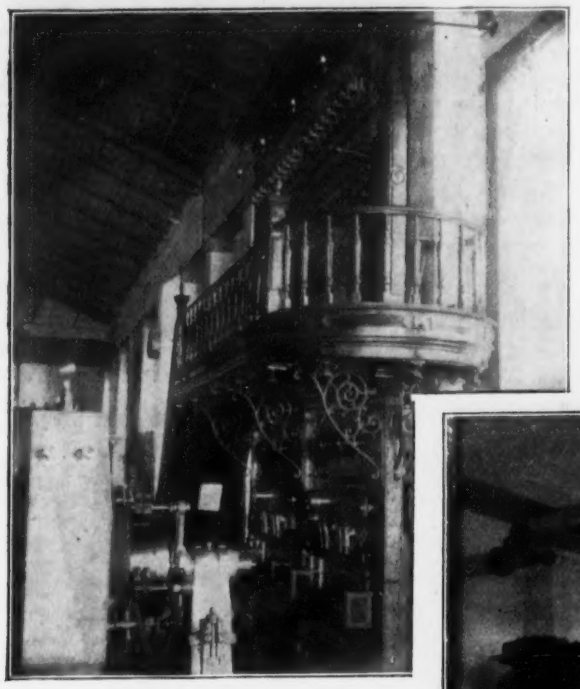


FIG. 3.—SWITCHBOARD.

lines are soon to be replaced by underground cables. Branch offices at Kuwana and Yokkaichi will be opened in 1900 with 100 nad 300 subscribers, respectively.

The curves of Fig. 2 represent various data referring to the Japanese telegraph service. In the main office there are 300 persons, which include 262 operators and 109 messengers. In branch offices there are 363 employees, which include 96 operators and 224 messengers. There are sides 28 engineers in the construction, repairing and testing departments. Bicycles have begun to be adopted for the delivery of telegrams, 19 being now in use.

In the main office there are 5337 Daniell cells and in the branch offices 1153 cells of the same type. The longest lines are two to Nagasaki, each 877 miles long. In the main office there are 48 simplex, 14 duplex and 3 quadruplex Morse registers, also 27 Morse simplex sounders and one duplex. Two Wheatstone automatics are also used, making a total of 95 instruments.

DATA OF JAPANESE ELECTRIC GENERATING STATIONS.

	Number of Stations.					
	Running.			In Course of Construction.		
	Central station.	Isolated station.	Total.	Central station.	Isolated station.	Total.
Lighting stations	34	199	233	14	19	33
Power stations	1	5	6	5	3	8
Lighting and power stations	20	20	40	23	4	27
Railway stations	3	1	5	12	..	12
Totals	58	225	283	54	26	80
Total horse-power generated			56,832			
Electric lighting	14,774	5583	20,357	1328	245	1573
Power	2080	284	2364	12,079	345	12,421
Lighting and power	3660	2305	5965	9021	572	9593
Railway	629	268	897	3659	..	3659
Total	21,143	8440	29,583	26,087	1162	27,249

Pressure at generator terminals of central stations now running:

Alternating current	1000— 3000 volts, 41. 5000—10,000 volts, 3.	Direct current	100—120 volts, 18.	Mixed system	6.

Number of incandescent lamps in the Empire		200,000
Saling price of 16-cp lamps		14 cents per lamp
Saling price of kilowatt-hour of electric power		8½—3½ cents
Length of electric railway routes, now running		23 miles
Number of cars used in electric railway, now running		40
Length of electric railway routes, in course of construction		185 miles
Number of incandescent lamps, 10—16-cp	In Tokyo	58,000
Number of arc lamps, 1000-cp	In Tokyo	156
Number of central stations for electric lighting	In Tokyo	3

The accompanying table gives statistics of all the lighting, power and railway plants of Japan.

Of the Tokyo station, which is naturally the largest, we present two views, one showing sets of 450-hp triple-expansion engines built by the McIntosh-Seymour Company, direct coupled to 300-kw three-phase generators built by the Allgemeine Elektricitäts Gesellschaft. The same station contains direct-connected sets of 350-hp triple-expansion engines and 250-kw single-phase generators built at Ishikawajimi Navy Yard at Tokyo, from designs by Professors Fujioka and Nakano. Fig. 3 shows the switchboard for these generators, there being a separate switchboard for the polyphase machines.

In Kyoto, current is supplied from a plant driven by water power, a canal from the beautiful Lake Biwa leading the water of the lake to the point of utilization. A full description of this very creditable hydraulic and electrical development appeared in the ELECTRICAL WORLD in the first issues of 1894. At present current is supplied to the Kyoto electric light and railway companies and also for manufacturing purposes. The chief engineer, Mr. Y. Kato, is a graduate of the Massachusetts Institute of Technology.

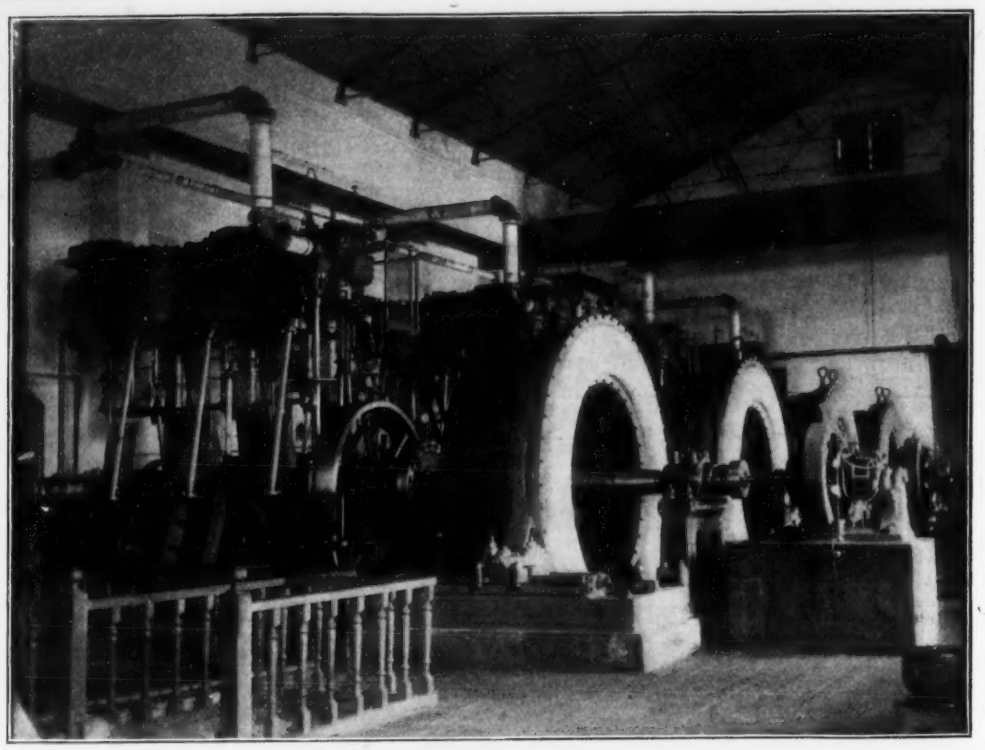


FIG. 4.—450-KW UNITS IN TOKYO STATION.

FIG. 5.—RUNNING TELEPHONE CABLES UNDERGROUND.

For the information contained in this article we are indebted, through the kindness of Mr. W. J. Johnston, to Prof. I. Fujioka; Mr. Oi, chief of Japanese Telegraphs and Telephones; Mr. Mayedu, of the Tokyo Electric Company; Mr. Niwa, of the Kobe Telephone Exchange; Mr. Wadachi, of the Nagoya Telephone Exchange, and Mr. Katogi, of the Telegraph Service.

Power Transmission at Albion, N. Y.

BY ORRIN E. DUNLAP.

ONE of the interesting power installations in New York State is that of the Albion Power Company. This company has a capital of $50,000, and was organized under the transportation corporation law of the state, and has acquired a franchise from the village of Albion to construct and maintain poles and wires for the purposes above referred to. It has also made a five-year contract with the trustees of Albion for lighting the village. The generating station of the company is located at Waterport, where the company has secured extensive water rights.

Acting under these rights the Albion Power Company has just completed a development that is valuable and novel. The water power at Waterport has been in minor use many years. The Otter creek runs into Oak Orchard creek above the dam of the Albion Power Company. This creek is of service because there is an overflow of the Erie canal at Eagle Harbor, where it crosses Otter creek. The overflow of the Erie canal at Medina also flows into Oak Orchard creek. Through these sources the Albion Power Company obtains enough water to develop 400-hp, under an 18-foot head. At Waterport there is quite a deep gorge, and across this gorge the power company has erected a dam 12 feet high, the remainder of the fall being obtained by carrying a tail race 1000 feet down Oak

FIG. 1.—POWER HOUSE AND DAM, ALBION, N. Y.

Orchard creek. The dam weir is 200 feet long and there is an earth embankment 100 feet long. The flume sets into the earth embankment, which is protected at the ends by masonry piers. All of the dam that is above water is of earth and stone. The flume is built of steel framework filled in with concrete, making a concrete wall two feet thick. The steel frame is designed to hold all the pressure, while the concrete fills in all the spaces, and thus making the concrete wall tight in all parts. In Fig. 1 will be seen the location of the power house and the dam. The power house is a brick structure and stands back of the earth embankment. The tail race is to the left. Power is derived from two McCormack wheels built by J. & W. Jolly, of Holyoke, Mass. One of these wheels has a capacity of about 175-hp, and the other is of about 250-hp capacity. The wheels are set in the open flume on a horizontal shaft, and discharge through a quarter turn and draft tube outside of the flume.

The generators in the station at Waterport were built by the Stanley Electric Manufacturing Company, of Pittsfield, Mass., and are self-ventilating, for service without oil, and designed for con- a capacity of 150-kw when operated at a speed of 600 r. p. m., and is wound for a maximum e. m. f. of 6600 volts at full load current. This machine generates current at 7200 alternations. The second generator has a capacity of 100-kw when operated at a speed of 900 r. p. m., and is wound for 6600 volts. Each generator is designed to operate in multiple. The station is also equipped with two 6-kw multipolar exciters, each capable of exciting the fields of the two generators when operating on a non-inductive load. They are arranged for belt driving from the shaft to the generator. One of these exciters is shown in Fig. 2, which is a general view of the interior of the power station at Waterport. The switchboard is of blue marble. The larger of the two generators is connected to the larger turbine, and the smaller generator to the smaller turbine. The

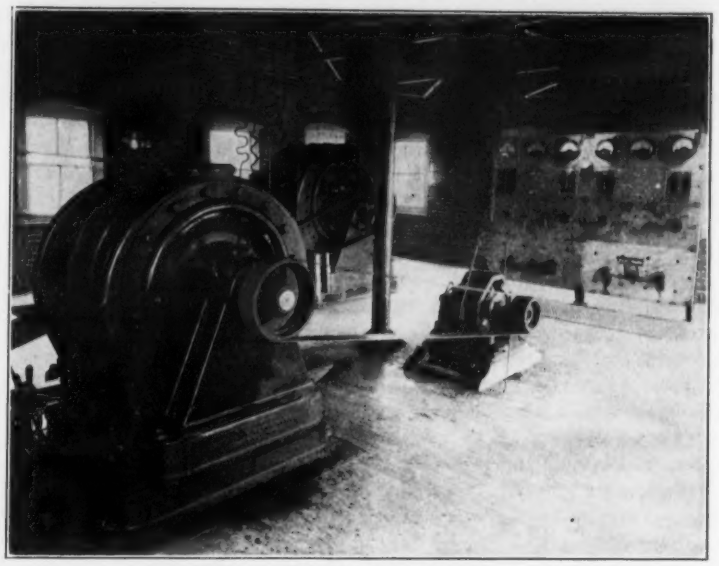


FIG. 2.—ONE OF THE EXCITERS.

generators feed direct to the transmission line without transformers.

From Waterport to Albion the distance is 6½ miles, and between these two points the Albion Power Company has erected a transmission line, the route taken being along the highway. The poles used are 30 feet high and are set 100 feet apart. The line is for three-phase transmission, each cable being made of seven pure aluminum wires. This cable was made especially for the Albion Power Company by the Pittsburg Reduction Company. The insulators used on the line are of the triple petticoated glass variety on porcelain base pin, an iron bolt running through the crossarm. The insulators were furnished by Fred M. Locke, of Victor, N. Y.

The Albion Power Company purchased the station of the old electric light company in that village and the power of the station at Waterport is transmitted to the station in Albion, now used as a substation, where the company have installed three static transformers of Stanley make, having a total capacity of 200-kw. They are of the three-phase, alternating current, inductor type. One has tinuous full load operation. These transformers reduce the voltage of the current from 6000 three-phase to 1100 three-phase. There has also been placed in this substation one 75-hp Stanley, inductor

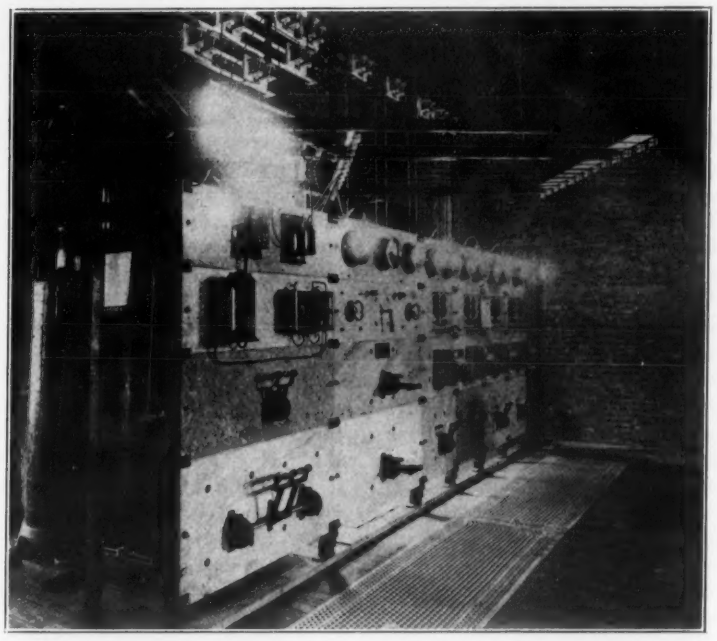


FIG. 3.—SWITCHBOARD AND TRANSFORMERS IN STATION.

dynamo for service as a synchronous motor, to operate on 1100 volts, three-phase, this motor being in every way a counterpart of the larger machine used in the generating station. There is also a one-kw exciter to excite the fields of the 75-hp synchronous motor, and

one 5-hp three-phase induction motor. The 75-hp motor drives an 80-light d. c. Brush arc machine for public lighting. The switchboard and transformers in the substation are shown in Fig. 3. This substation is equipped with an engine, making a complete relay up to the capacity of the station.

The business part of the village of Albion is laid out in three districts, in each of which there are installed on the street three 300-light transformers, connected in multiple, stepping down to 110 volts. Each district is connected with one leg of the three-phase line. Running around the outskirts of the town there is a three-phase line from which all power and outside lighting is furnished.

The chief engineer of the company is Mr. Wallace C. Johnson, of Niagara Falls, whose knowledge of power development in all its features has been invaluable to the new company. The contract for the building of the power house and dam at Waterport, the equipment of the power house, the construction of the transmission line from Waterport to Albion, and the rebuilding of the substation at Albion, were given to the Niagara Electric Company, of Niagara Falls, of which W. L. Adams is the head. This company sublet the contract for the dam and power house construction, but it was all done under their supervision. All of the electric features of the installation both in Waterport and in Albion were very satisfactorily taken care of by the Niagara Electric Company. Crage & Tench had the subcontract on the dam and power house. The officers of the Albion Power Company are: President, Hon. Frank A. Dudley, of Niagara Falls; vice-president, George T. Lum, of Waterport; secretary, Sanford T. Church, of Albion; treasurer, Raymond D. Johnson, Buffalo; engineer and general manager, Wallace C. Johnson, M. Am. Soc. C. E., Niagara Falls. The president of the company, Hon. Frank A. Dudley, is an attorney of high standing at Niagara Falls. He was the partner of Hon. W. Caryl Ely, now of the International Traction Company, for many years, and had the personal supervision of the organization of the Albion Power Company. Mr. Dudley is very much interested in power and lighting and was connected with the organization of the Niagara Falls Power Company. Messrs. Dudley and Johnson have organized the Waterport Manufacturing Company, and will sell power to the new company.

Reversal of Polarity of Generators.

BY A. S. MCALLISTER.

In the service required of generators for the modern underground haulage system and similar installations, the reversal of polarity of one or two or more compound generators running in parallel is of only too frequent occurrence. Any method of immediately righting such reversal cannot fail to be of value to those so often annoyed by this trouble.

The method of re-reversing the magnetism by raising the brushes from the commutator and charging the shunt fields from another generator, is familiar to all. With large generators having many brushes, this method is found quite slow, and unless the shunt field is provided with a switch and discharge resistance, the opening of the field circuit, even though an attempt be made to slowly lengthen out the arc, is liable to strain and possibly pierce the insulation of the shunt windings. The very convenient method outlined below was found, at first, interesting as an experiment, and afterwards profitable in its practical application.

This method employs the series coils to re-reverse the magnetism. When a generator has merely reversed its polarity, the fact will be made known by an attempt of the voltmeter to register negative voltage, and the generation of such negative voltage is a fair indication that the machine is in running condition, except for the reversal of polarity. To a generator, having a shunt field switch with a discharge resistance and three independent main circuit switches, the following method is immediately applicable. Such modifications as may be needed for other generators will be given later.

Let us assume, for illustration, two compound generators, the polarity of one of which has become reversed, and designate the generator of proper polarity as *A* and the other as *B*. Suppose *A* to be in service and carrying its load, or may be an overload. Having *B* disconnected from the bus bars but running at full speed, open its shunt circuit switch. The small negative voltage now shown will be that due to the residual reversed magnetism. Close the equalizer switches of both machines and the main circuit switch on the series coil side of *B*. The current from *A* will be shunted through the series coils of *B*, usually in such quantity as to reverse the residual magnetism, and this fact will be indicated by the voltmeter of *B*, which will now register a small positive voltage. Close the shunt circuit switch of *A*. The machine should at once begin to build up, and when the working voltage is reached the third main switch may be closed and the generator given its proper share of the load.

The amount of current shunted through the series coils of *B* will be inversely as the total resistance of the equalizer connections of both machines and the series circuit of *B*, as compared with only the series circuit of *A*. If such amount be found insufficient to reverse the magnetism of *B*, by opening the series circuit of *A*, the whole current from this machine may be forced through the series coils of *B*, and under working conditions will not fail to cause this generator to build up properly.

With the generators equipped as assumed, the process of righting the magnetism and giving the machine its load will require no more time than that consumed usually in building up the magnetism and connecting the machine to the bus bars. In cases where the generator is not provided with a field switch and discharge resistance, it is best to stop the machine and then effect an opening in the shunt circuit by insulating the sliding brush of the rheostat from the contact posts.

A generator supplied with a three-jaw switch may be excited by this method, by disconnecting from the generator the lead from the switch which is not desired to be used in throwing the series coils in parallel.

It may be well to note that this method cannot be applied to a Thompson-Ryan or similar generator; for the series current in the balancing coils will not be in position to reverse the magnetism.

Independent Telephone Advances In and Around Boston.

The recently incorporated Continental Telephone, Telegraph & Cable Company, which has for its reputed object the combining of all the independent companies operating lines throughout the country, is partially a New England organization, inasmuch as important factors in that combine are the Massachusetts Telephone & Telegraph Company and the Boston & New York Telephone & Telegraph Company. Mr. Z. S. Holbrook, president of the former, and vice-president of the latter, does not hesitate to say that Boston subscribers to the new local service would immensely benefit by the proposed consolidation.

The two companies alluded to above are in a sense one concern, though the former is incorporated in Massachusetts, the latter being a Delaware corporation with a large capitalization. The former secures the franchises, while the latter does the construction work. Progress is being made in and around Boston in the laying of conduits, etc. Thus far, by employing a very large staff of men, several of the main streets in the city have been opened up, the conduits laid and manholes built. Several miles of this work have been completed, and at the present time construction is being pushed around by the new South Terminal Depot, towards South Boston, the plan being to get that important manufacturing territory equipped at as early a date as possible.

Concurrently with the laying of conduits for city service, pole line construction for long distance service is being rushed vigorously. The plan is to connect Boston and New York, and Providence and other intermediate cities, first, and to have that line ready by the time the local service is ready if not before.

There are already four gangs of men at work on the long distance line. At the present time two of them are busy at Stoughton, one at Easton and another at Taunton. Another gang is likely to begin right away near Providence should the weather continue favorable, the plan being to complete the line between Boston and New York by spring if possible.

When the Massachusetts Company entered the field in Boston they hoped to be able to furnish their patrons with service in about a year's time, and every effort has been made to accomplish that purpose, but the details incidental to perfecting the more comprehensive organization has interrupted the work somewhat, hence the delay, but now work will go along with greater push than ever. The company has secured something like 5000 contracts in Boston already, which is an indication of the business they are likely to do when their plans are complete. It has not yet been decided just in what part of Boston their central exchange will be built, and work on it may not begin before next spring. Meantime, they are making many new contracts daily, and the company will begin business with not a few of the leading firms in the city as its customers.

Combined Street Car and Omnibus.

The accompanying illustration shows a German vehicle built by the Siemens & Halske Electric Company and designed to fill a gap in methods of public traffic. The vehicle is intended for use as an ordinary automobile for taking short cuts between various parts of a city, and to be run on the tracks of electric railways when it happens to come on a street where the same exist. It also meets the requirements of some cities which will not permit electric cars to pass through certain thoroughfares.

As will be seen, there are two guide wheels in front which are

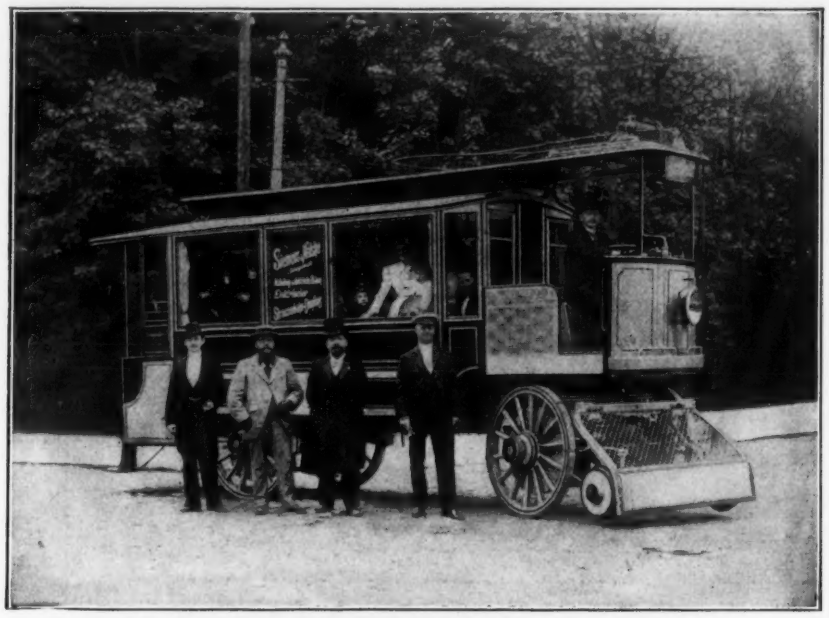


FIG. 1.—COMBINED STREET CAR AND OMNIBUS.

lifted up during the passage of the vehicle through streets without tracks, and which serve to guide it on electric railway tracks. In the first case the usual form of steering gear is used, which in this instance allows the front carriage to move around to an angle approaching very nearly to 90 degrees, thus making it possible to turn into very narrow streets. There are two sets of brakes, one a mechanical shoebrake acting on the rear wheels; and for use with heavy loads

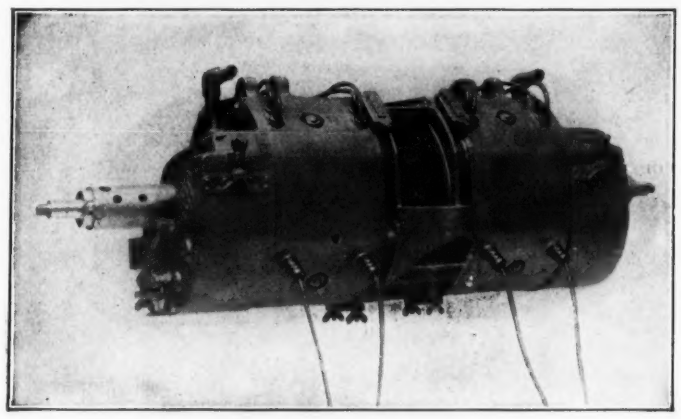


FIG. 2.—ONE OF THE MOTORS.

there is an electrical locking brake operated from the controller, and which brakes all four wheels.

The vehicle is supplied with a storage battery and when running on tracks the current taken from the trolley not only operates the vehicle but charges the storage battery. As will be seen from the illustration, the trolley is of the well-known Siemens & Halske bow type. Four motors of the type shown in Fig. 2 are used, one to each of the four wheels. They are each of 4-hp at 350 volts and 500 r. p. m. The storage battery weighs 3300 pounds.

The Electric Plants of the Battleships Kearsarge and Kentucky—II.

MOTOR CONTROLLERS AND BRAKES.

The motor controllers used on the Kearsarge and Kentucky are of the well-known electric railway type. Five different kinds are used, divided into three general classes, according to the kind of work that they are to perform, and arbitrarily designated as "R," "B," and "P."

The "R" controllers are rheostatic in their method of operation, and are used for the purpose of starting, stopping, reversing and controlling the speed of the motors. They are particularly adapted for motors designed to carry a load in either direction. In this type of controller the combinations are such that when the cylinder is turned to the first position in one direction, the motor armature and field are connected to the line, and have in circuit a rheostat. On further rotation of the cylinder, the rheostat is gradually short-circuited, until at the last position of the cylinder it is entirely cut out of circuit, the motor then attaining its maximum speed. On returning the handle to its original position, the rheostat is again introduced into the circuit, and the motor is slowed down and stopped. When the cylinder is turned in the opposite direction, the same effect is produced with the rheostat, but the direction of current through the armature, but not through the field, is reversed, and the armature rotates in the opposite direction. Two kinds of "R" controllers are used, one with the 13-inch rammer and elevating motors, and the other with deck winches.

The "B" controllers are designed to give electrical braking, the motor being made to run as a generator by the momentum of its armature or load, and in this way reduce its speed or stops itself. Two kinds are used; in one kind, used on the 13-inch and 8-inch ammunition hoists, and the 6-pounder ammunition winches, the various combinations are made on a single cylinder; while in the other kind, used for boat cranes, the braking effect is obtained by means of a second cylinder independently operated. In both kinds of these controllers the contacts are so arranged that in hoisting a load the operation is exactly the same as on one side of the "R" controllers, but when acting as a brake controller for lowering a load or for carrying very light loads, a different combination is made, so that the rheostat to which the controller is connected, instead of being in series with the armature and gradually short-circuited as the armature is brought up to speed, is connected across the line in shunt with the armature. By this arrangement a small amount of current is taken from the line through the rheostat during the time that the armature is being operated, besides the current taken or given out by the armature itself.

On the first brake position of this controller the rheostat is connected across the line and the armature is in shunt with a very small portion of the rheostat, so that if the load is sufficient to start the motor it will operate as a generator, passing a certain amount of current through the armature and this small portion of the rheostat with which it is in shunt; but if the load does not start the motor, the armature will receive a small amount of current from the line through the rheostat. If the armature does not start in this position, turning the controller cylinder further will connect it in shunt with a greater portion of the rheostat, thus causing it to run faster if the load drives it as a generator, or causing more current to pass through the rheostat into the armature in case it does not start. As the cylinder is turned still further the armature will be brought up to full speed, no matter whether the load is sufficient to drive it as a generator, or whether it requires current from the line to run it as a motor. In this way the speed can be controlled within proper limits, no matter whether it is lifting the load or is driven by its load.

Three kinds of "B" controllers are used, one with 8-inch and 13-inch ammunition hoists, another with the 6-pounder ammunition winches, and the third with boat cranes.

The "P" controller is used where the voltage of the generator is to be varied in order to obtain a change of speed of the motor, and is therefore called a variable voltage controller. There is only one

kind of these controllers on these ships, being used for controlling the rotation of the turrets. It is radically different from the other controllers, both in design and in system of control, although it retains the same general features, the proportion and arrangement of the contacts being quite different.

It is essential in this controller that it should operate easily so as not to interfere with properly sighting the gun, and yet should have a plainly marked point at the off position. As the main circuit is broken only at the time of starting and stopping, it is not necessary to have other notches, because the current controlled by the upper part of the cylinder is very small. The handle, instead of being carried on the main cylinder shaft, as in the case of other controllers, is carried on the secondary shaft connected by pinion, and gear of about 4 to 1 reduction, so as to more easily operate the main cylinder. The main cylinder turns nearly half a revolution in each direction from the off position, but to accomplish this the handle itself turns more than three and one-half revolulutions. The gear itself carries on its top surface marks to show the position of the cylinder. If it is desired to operpinion gear may be easily removed and the handle put directly on the main shaft; in which case the index points on the cap plate will show the position of the cylinder.

The controlling panels are supplied with all chain ammunition hoists and blowers. Fig. 7 shows one for a 50-inch ventilation fan. They are similar in design and construction but differ in details in order to make them applicable to the three kinds of motors they operate. The panel consists of an enamel slate slab 24 inches by 12 inches, carrying on its rheostat arms, the rheostats being on the back. The rheostats are protected at the side but not at the top and bottom. The front is guarded by perforated hinged cover fastened by a padlock. The terminals for wires are on the back of the slate at the top and bottom. The field rheostat is connected in series with the field, and regulates the speed of the motor. The plate shown above the rheostat contacts indicates the arm that should be turned against the sun to reduce the speed, and with the sun to increase it, the plate being marked "fast" and "slow." The starting rheostat at the bottom of the panel is to start the motor, and also to protect it from damage in case of an overload or failure of current. This rheostat is never used for speed regulation. The automatic release magnet, located at the upper left hand side of the rheostat face, is designed to hold the arm on while the circuit is alive; but when the armature fails to release the arm, which will be thrown off by a spring. A magnet at the lower right-hand corner of the rheostat is designed to protect the motor against overloads. This coil is connected in series with the motor armature and attracts an iron armature pivoted at one end and resting horizontally below it.

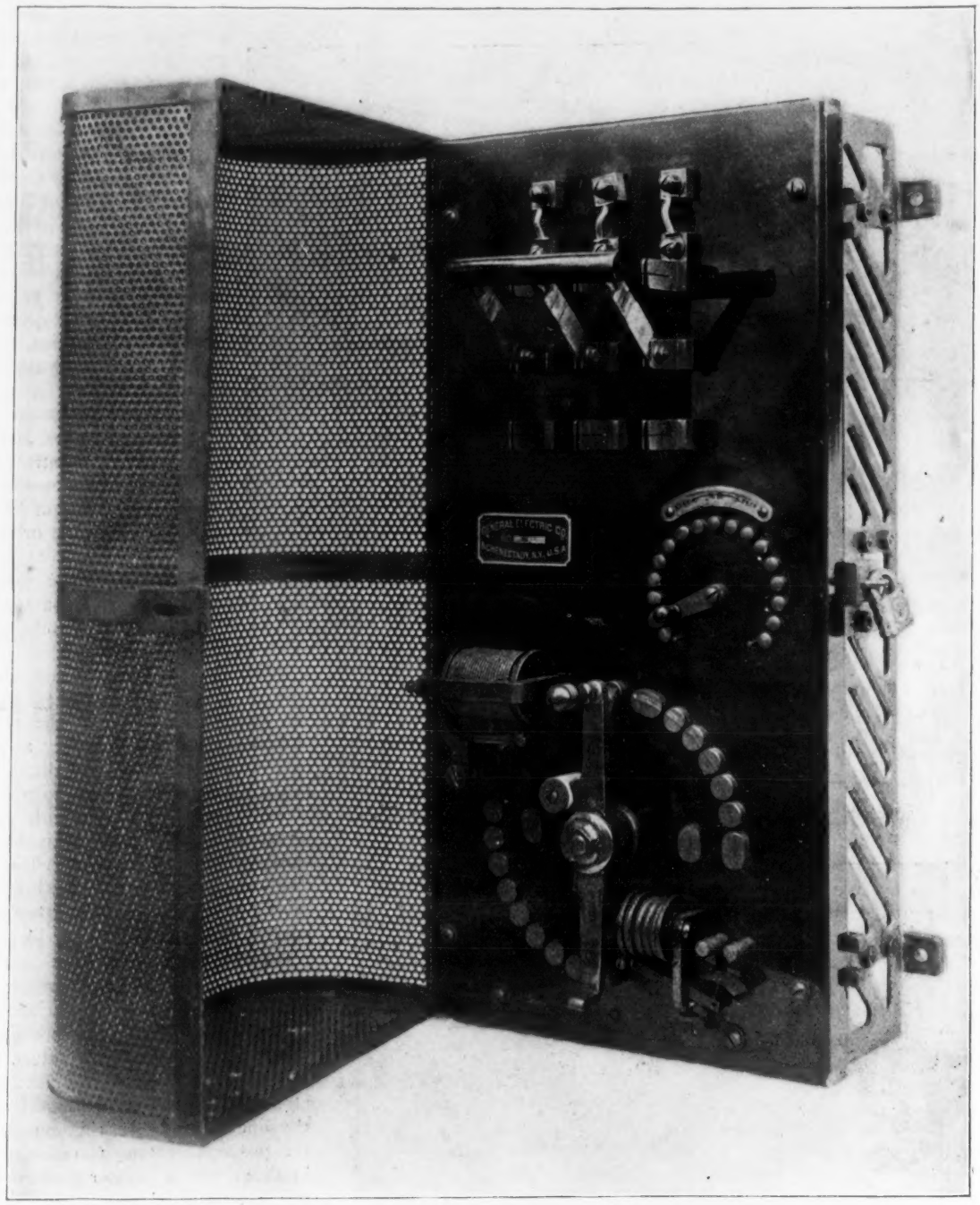


FIG. 7.—CONTROLLING PANEL FOR VENTILATION FANS.

Solenoid brakes are used upon the 13-inch ammunition hoists and the chain ammunition hoists. These are band brakes designed to stop the motor when the current fails. The mechanism consists essentially of a wheel, band, solenoid and lever. The wheel is a flat-faced pulley, located on the armature shaft. The solenoid consists of two spools, the cores of which are attached to the brake lever and lifts the same when energized; consequently when the current is passed through the cores upon the operation of the controller, the brake is automatically released and remains off until the circuit is broken, either intentionally or accidentally, when it is autor atically applied.

Each double turret is turned electrically, the H. Ward Leonard method of speed control being employed, which system is based upon the use of variable voltages at the motor terminals.

There are two 50-hp electric motors, located below the floor of each 13-inch turret. These motors are regulated in speed and direction by a controller, situated under the sighting hood, between the 13-inch guns. The operator has only to turn his controller handle from the "off" position in the direction in which he wishes the turret to move, and the motors will drive the turret as desired, the speed of travel being dependent upon the amount which the handle has been displaced.

The method of control requires that each turret shall have one independent generator, with variable field, for the supply of the

turning motors, but the dynamo switchboard is so designed that any generator may be used for either turret. To accomplish this the field rheostat on the generator panel board is cut out, and in its place another rheostat in the turret, of wide range and operated by the controller, is used, the generator field wires being carried to the turret for this purpose. The series coil of the generator is short-circuited by a switch on the headboard.

The armature terminals of the generator are connected through the necessary switches, etc., directly to the armature terminals of the motors. The motors are in multiple, and have their fields separately excited at constant potential from the switchboard. As the engine drives the dynamo armature at a constant speed, the volts delivered by it to the motor armatures are approximately proportional to the generator field excitation, and consequently the speed of the motor armatures, and, therefore, of the turrets, may be directly controlled by the operator in the turret.

The current required is dependent upon the turning moment necessary to overcome mechanical resistance, and will not vary greatly at any constant speed, regardless of what that speed may be. The circuit is so arranged that either motor may be electrically cut out and the other motor be operated to the extent of its capacity.

If, when the motor is in motion, the controller is turned to such a position that the armatures would be driven as motors at a lower speed than that corresponding to the speed of the turret, the turret will drive the armatures, which will immediately generate current and absorb energy, bringing the turret down to the speed of the armatures when running as motors.

The controller, in addition to operating the generator field rheostat, also sends the current to the motor armatures in the direction to give the rotation required.

There is one 50-hp motor, with the armature and field each wound for 80 volts, located on each side of the 13-inch turret below the floor. (Fig. 8.) They revolve in the same direction, both driving through bevel gears to one shaft, which runs across the turret, as shown. This shaft carries at one end a right-hand and at the other a left-hand worm, each of which engages with a worm wheel at the top end of a vertical shaft. At the lower end of the vertical shaft of each of the worm wheels is a pinion which meshes with the circular rack inside of the barbette, thus driving the turret.

The worm wheels are connected to vertical shafts by friction clutches, which can be adjusted by nuts above to carry the desired load, but to slip if it be exceeded in order to prevent damage to the driving mechanism due to an excessive overload such as would occur when firing one gun, or possibly in the case of impact of a shell on the outside, tending to produce rotation independently of the motors.

The object of the cross-shaft is to allow one motor to revolve the turret by driving both pinions should the second motor be mechanically disconnected, and also to permit one motor to revolve the armature of the other motor in case the latter should fail electrically, through the bevel gears instead of through the worm wheel and worm, which would be the case if the cross-shaft were not employed.

The turret controller is located on a platform, between the 13-inch guns, under the sighting hood. It consists of a cylinder carrying a set of contacts for producing the desired combinations to give the proper speed and direction of rotation to the armatures. The cylinder performs two distinct kinds of work. The upper part has nine contacts for the generator field rheostat, and controls the speed of the motors. The lower part supports a number of segments which are connected with the armature circuits. Eight wide ones control the direction of rotation and carry all the armature current of both motors. Two of them also have contacts which introduce a brake resistance across the motor brush terminals when the controller is off, so that the momentum of the turret and armatures is checked by the energy required to drive the motor armatures as dynamos, thus generating current through the brake rheostat. In addition to the wide segments, there are six narrow ones connected with them. These make contact with their respective fingers a little before, and brake a little after, the segments with which they connect. They introduce into the armature circuit auxiliary resistances, the object of which is to decrease the volume of current at the first instant of contact, and also reduce the amount at the final break. This diminishes the possibility of sparking at all points.

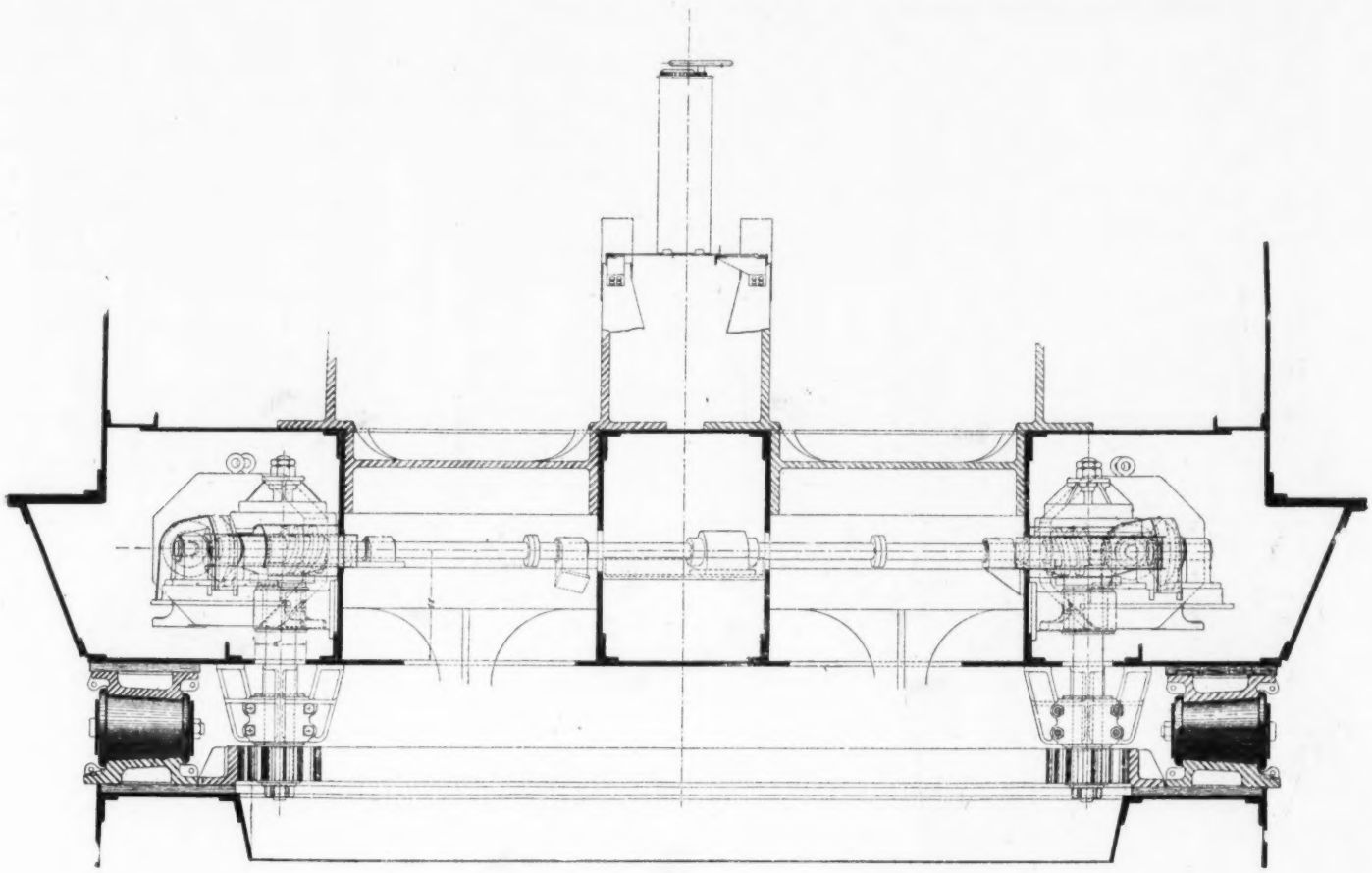


FIG. 8.—TURRET ELECTRICAL TURNING GEAR.

Warsaw, Poland, Central Station Plant—IV.

TRANSFORMERS.

The transformers are distributed in such a manner throughout the network that a large capacity is concentrated in one transformer, the lengths of the secondary circuit do not exceed the permissible amount, and the cross-section of the cables is fully utilized. We thus have in districts with large consumption four and sometimes more transformers for each block of houses, in districts with average consumption, two or three transformers, and in portions of the city in which the demand for current is very small, one to two transformers for each block of houses.

The most convenient location for transformers are the street crossings, where, according to current consumption, two, four or eight secondary circuits branch out from each transformer; in heavily loaded districts, therefore, we find four transformer pits at one street crossing and at less heavily loaded districts three, two or one transformer. In case the demand for current should be increased in the near future, more transformers could be installed at the empty street corners; this has been taken into account in the laying of the cables. The mean distance between transformers within city limits is from 300 to 500 feet, on the outskirts from 500 to 650 feet, and in exceptional cases 1000 feet or more.

Three types of transformers are proposed for this installation, namely, of 15, 25 and 35-kw capacity, which correspond in round numbers to 300, 500 and 700 incandescent lamps. The transformers receive the electrical energy at 4000 volts pressure, and 1: 32 has been selected as the ratio of transformation, so that the electrical energy is delivered at the secondary terminals at 125 volts pressure. The transformers have been so designed that the smallest no-load consumption, the highest efficiency and the greatest safety during operation are secured. The efficiency and no-load consumption of the three sizes of transformers are as follows:

	15-kw.	25-kw.	35-kw.	
The efficiency in per cent. at full load....	96.	96.5	97.	
The no-load consumption	300	400	500	watts.
Or in per cent. of full load.....	2.	1.6	1.43	
The drop of pressure between no load and full load	2. — 1.6 per cent.			

The losses are thus reduced to a minimum. The total number of transformers installed in the 19 districts is 97 15-kw, 429 25-kw and 118 35-kw, having a capacity of 1455, 10,725 and 4130-kw respectively, or a total of 16,310-kw, capable of supplying 326,200 incandescent lamps. The secondary wires are designed for a capacity of 23,658-kw, equal to 473,141 incandescent lamps. Their total length is 167 miles. In several instances the transformer capacity has been chosen larger than that of the secondary wires connected to it, as cases may arise when it is deemed advisable to connect very large consumers or street arc circuits directly to the transformers by special cables.

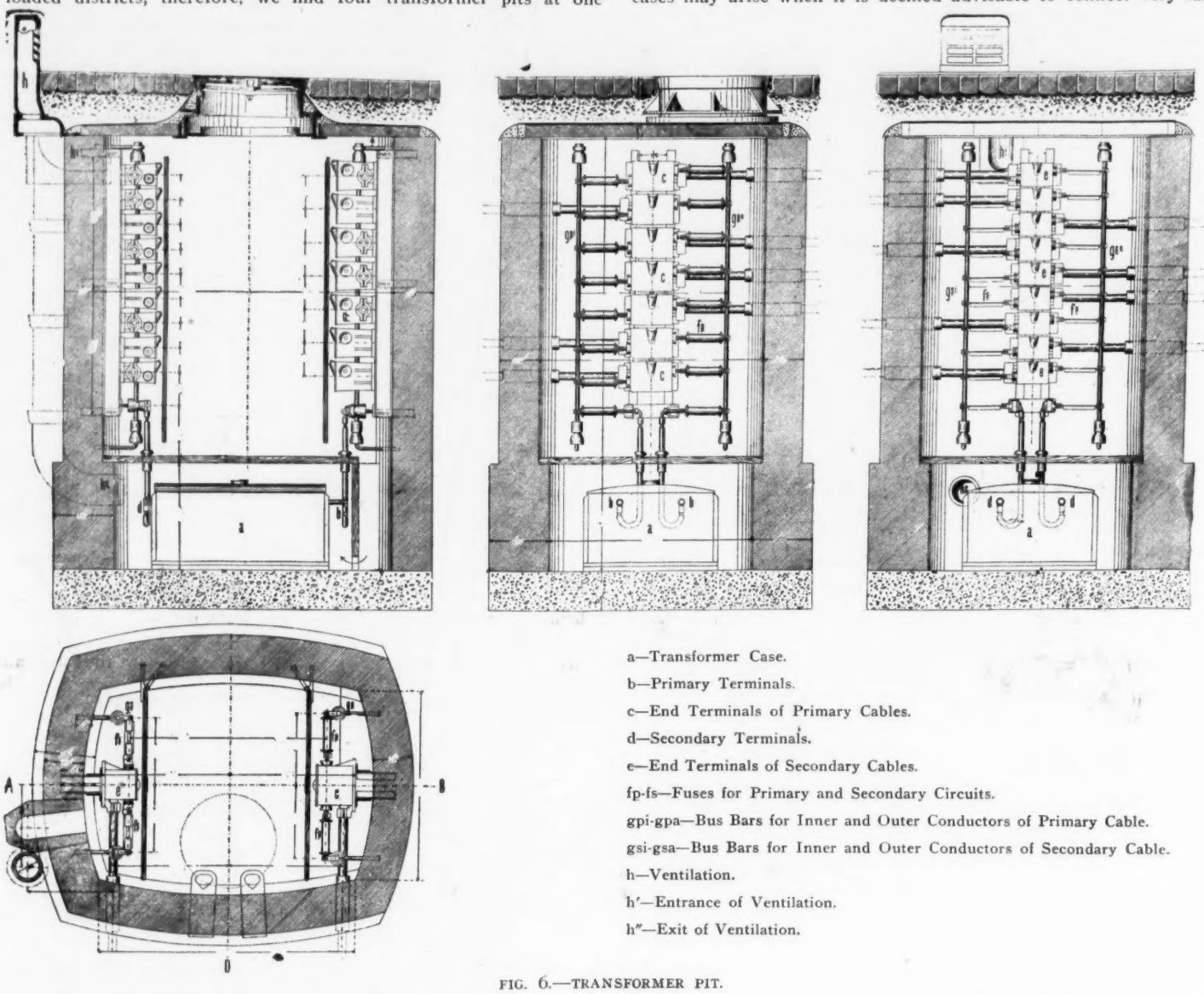

a—Transformer Case.
b—Primary Terminals.
c—End Terminals of Primary Cables.
d—Secondary Terminals.
e—End Terminals of Secondary Cables.
fp-fs—Fuses for Primary and Secondary Circuits.
gpi-gpa—Bus Bars for Inner and Outer Conductors of Primary Cable.
gsi-gsa—Bus Bars for Inner and Outer Conductors of Secondary Cable.
h—Ventilation.
h′—Entrance of Ventilation.
h″—Exit of Ventilation.

FIG. 6.—TRANSFORMER PIT.

TRANSFORMER PITS.

The transformers have been installed underground, as the highly efficient drainage system of Warsaw warrants such a proceeding. This has the advantage of not requiring the construction of towers or transformer houses and of enabling the installation of transformers at any desirable location. It further has the advantage of not bringing the high-tension alternating circuits into the houses and of enabling workmen to have access to the transformers at all hours of the day and night. Such pits have been used at Frankfort with great success. The pits have been built of such a size that they will accommodate the largest type of transformer, i. e., 35-kw; the subdivision of transformers into larger units is not to be recommended. A 35-kw transformer can be kept cool by ordinary means, and an efficiency of 97 per cent. is sufficiently high for all practical purposes.

At present transformers have been installed to meet the demand at each transformer station, and the number of transformers of each type is given above. Should the demand increase the small sizes can be replaced by larger ones.

The pits and the transformer connections are clearly shown in Fig. 6. The pits are 5 feet wide, 6.5 feet long and 9.5 feet deep. The lower chamber contains the transformer. In order to protect it from moisture and water it is placed into an oiled box.

The incoming and outgoing cables pass through the side walls, the high-tension (primary) cables through the wall toward the street. and the low-tension (secondary) cables through the wall facing the houses. A pit of the above dimensions will accommodate seven high tension and nine low tension terminals, including all connections and switches. On the walls toward the right and left of the transformer terminals are the vertical bus bars mounted on insulators, which are connected with the primary and secondary terminals of the transformer. The connection between the cable and the bus bars is made by means of clamps fastened at one end to the end terminals and at the other to the bus bars and by the insertion of a fuse. By means of these fuses the cables are connected to and disconnected from the bus bars. The transformer chamber is covered by a piece of wood or a glass plate. On the sidewalk, close to the house foundations, a small ventilating chamber is constructed which is divided in the vertical plane into two parts. The right half is connected with the pit just below the cover, the left half with the transformer chamber immediately below its cover. In this way the heat developed by the transformer is conducted away and a thorough ventilation of the transformer pit is secured.

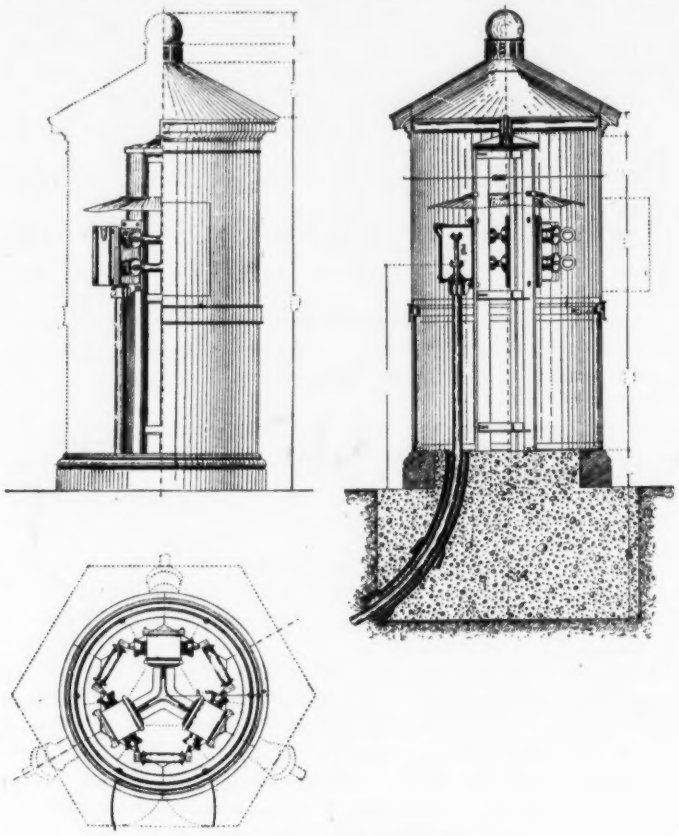


FIG. 7.—EQUALIZER TOWERS.

The pit is covered by layers of concrete resting on iron supports, and is closed by a watertight manhole. The whole is then covered directly under the street pavement by a layer of asphalt, which fills up all crevices and excludes moisture. The opening in the cover is sufficiently large to permit the removal of the transformers (exclusive of oiled boxes). The walls are built of cement, covered with glazed tiles, which excludes moisture and gases. The bus bars and connectors are separated from the central portion of the pit by means of doors and are secured against accidental contact.

EQUALIZER TOWERS.

The equalizer stations, on the other hand, are built above the ground, and are shown in Fig. 7. They consist of circular towers about 3.5 feet in diameter and 9.2 feet high, in which the terminals are fastened to three or four cornered wrought-iron frames, their number depending upon the number of auxiliary and equalizer circuits entering the tower. These circuits are connected in a manner similar to that employed in the transformer pits, and in this way a ring circuit is formed which permits the switching in and out of a circuit without interruption of service.

The upper portion of the tower can be turned around an axis, and is provided with a door so that the inspector can reach any of the switches and terminals. To protect the connections against moisture and condensed water a double roof is provided, and the parts which have to be thoroughly insulated are covered by slanting glass plates, as shown in the figure. There are in all only four such towers in Warsaw, and one in Prague, so that there can be no objection raised against the overhead construction, which furthermore permits rapid access to every part, and can be attended to by one man against a couple or more in the case of a pit. The fuses, which protect the circuits against serious grounds and short circuits, are of such a construction as to guard against prolonged arcing, which would tend to keep the circuit closed.

SECONDARY CIRCUITS.

The secondary conductors have a cross-section of 2 by .155 square inch, and are designed to distribute electrical energy at 120 volts pressure and a maximum drop of from 1¼ per cent., or 1½ volts. They run directly from one transformer pit to another, being connected to the respective bus bars, and are fed from two sources. They can be disconnected at either pit. All house connections, with the exception of several large consumers are made directly to the secondary circuits, which avoids the hundreds of connections being made to the primary circuits. The high-tension cables can in most cases be laid in one piece from pit to pit without any other connections, excepting the end terminals. This insures the safety of the network of conductors and continuous service, and the danger to employees is considerably decreased.

LOCATION OF CONDUCTORS.

The secondary conductors are situated close to the front walls of buildings, and two sets of conductors traverse each street, one on each side. In this way the street car lines are protected from these circuits and the conductors from the work which is constantly being done on the roads; they are located in dry soil, the house connections are short and inexpensive, and the traffic on the sidewalks and roadway is not crossed or disturbed during construction. In such thoroughfares where there is only a small demand for current and not much traffic, one cable only is laid until such time when the increased demand necessitates the second cable on the other side of the street.

The primary, auxiliary and equalizer circuits, running in the same direction as the secondary ones, are laid parallel with the latter and at the same time in the above-mentioned protected location. The conductors are buried at a depth of from 2¼ to 3¼ feet. The greater depth is recommended as the conductors are then less affected by frost and the contractions and other movements occasioned hereby. Two cables are placed in most of the trenches, that of the primary and that of the secondary network; the former toward the houses on a higher level, the latter toward the curb on a lower level. The cables are protected by a cover consisting of bricks or a layer of cement, which is sufficiently strong to resist a heavy blow from a pick or other carelessly handled tool.

At street crossings under the car tracks the cables are drawn through cast-iron pipes; these reach from one side of the street to the other, are laid at the above-mentioned depth, and are made tight by means of lead joints. These pipes are laid in advance, so that the pavement can all be replaced before the drawing in of the cables is begun. The street traffic will, therefore, not be interrupted, and the work be accelerated.

Concentric cables with paper insulation, lead covering and iron strip armor are used, this latter being an extra safeguard.

SUMMARY OF THE DISTRIBUTING SYSTEM.

Although space does not permit the complete publication of all the data and figures as well as methods of calculation of the distributing conductors, which are fully and ably presented by Mr. Lindley, we will present a general summary which might prove of interest. Before doing so, however, it should be remarked that in calculating the primary as well as the secondary conductors, it is assumed that each length of cable delivers energy at 5 points. The drop of pressure in such a case would be—

$$\frac{5+4+3+2+1}{5\times 5}=6$$

of the drop which would take place in the conductor if all the energy

were delivered at one end. Therefore, the coefficient 60 in the formula

$$e = \frac{l \times i}{60 \times q}$$ in which e = drop in volts,
l = length of cable (both ways),
i = current in amperes,
q = cross-section of conductor in square mm.,

becomes 100 and the formula

$$e = \frac{l \times i}{100 \times q}.$$

It is further assumed that each secondary cable is fed from two sides and only half the length between transformers is used in the calculations.

I.—INDIVIDUAL EFFICIENCIES.

(a) Steam Engines:

No load, 6 per cent.

Efficiency at ¼ load	0.760
Efficiency at ½ load	0.840
Efficiency at ¾ load	0.875
Efficiency at full load	0.890

(b) Alternators:

Efficiency at ¼ load	0.85
Efficiency at ½ load	0.92
Efficiency at ¾ load	0.94
Efficiency at full load	0.945

(c) Main Feeder:

Efficiency at maximum load and 2 per cent. drop	0.98

(d) Primary Circuits:

Efficiency at maximum load and ½ per cent. drop	0.995

(e) Transformers:

No load

Of the 15-kw transformer.....300 watts =	2 per cent.
Of the 25-kw transformer.....400 watts =	1.6 per cent.
Of the 35-kw transformer.....500 watts =	1.43 per cent.
Drop between no load and full load	1.6 to 2 per cent.
Efficiency at full load—	
Of the 15-kw transformer	96.0 per cent.
Of the 25-kw transformer	96.5 per cent.
Of the 35-kw transformer	97.0 per cent.
Average efficiency of transformers at full load.	96.5 per cent.

(f) Secondary Circuits:

Efficiency at 120 and 240 volts respectively at full load and 1¼ per cent., i. e., 1.5 and 3 volts drop respectively	0.9875

(g) House Circuits:

Efficiency at full load under secondary circuit conditions	0.9875

II.—COMBINED EFFICIENCIES AT MAXIMUM CAPACITIES.

(a) Steam engines and alternators	0.89 × 0.945 = 0.841
(b) The distributing system from the secondary terminals of the transformers	0.975 × 0.965 = 0.941
(c) The secondary circuits and the house circuits from the secondary terminals of the transformers to the lamps (a double loss of 1½ volts)	0.975
(d) The complete distributing system from switchboard to lamps	0.975 × 0.965 × 0.975 = 0.917
(e) The distributing system from the main feeding points to the lamps	0.975 × 0.965 × 0.975 = 0.936

Therefore, for each 50 watts at the lamps there must be produced:

At the secondary terminals of the transformers	51.3 watts
At the main feeding points	53.4 watts
At the switchboard	54.5 watts

Electrical Development in Brazil.

Mr. F. S. Pearson, of Montreal, has arrived from San Paulo, Brazil, where a company of Toronto and Montreal capitalists is putting in a street railway and electric lighting plant. The city of San Paulo has a population of 250,000, and there was already a small electric lighting plant (which the new company has acquired), and a little mule street railway is also in operation there. The Canadians have a thousand men employed rushing the work, and will probably have their line in operation by February. They are well advanced with work on the big dam, which will develop 10,000-hp to work both electric lighting and trolley plant.

The Invention of the Coherer.

By Camillo Olivetti.

THE object of this article is to show that the real inventor of the coherer, which is certainly the most important piece in Marconi's wireless system of telegraphy, is Dr. Temistocle Calzecchi Onesti, of Fermo, now professor of physics at a school in Milan; and not, as generally believed, Prof. Branly, of Paris.

Dr. Onesti in 1884, while a student at the University of Pisa, undertook the study of the conductivity of pulverized metals, and published the results of his researches in the *Nuovo Cimento*, the old and celebrated scientific journal published in Pisa.

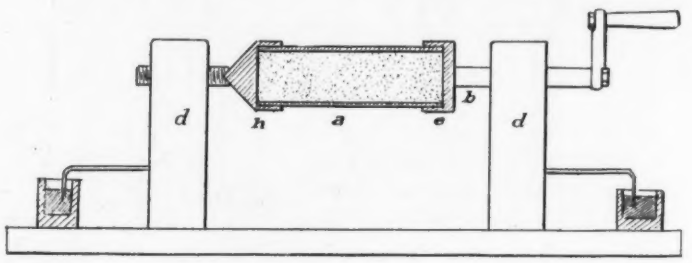
In order that the reader may see that while he was engaged in this work he was led not only to construct an apparatus which is nothing else than a real coherer, but that he also studied the peculiar properties of the same, and especially the behavior of this apparatus if submitted to electrical waves and impulses, I will translate the most important parts of his two articles, one of which appeared in the number of March 2, 1886, and the other in the number of October 15, 1884.

"If a small glass tube is filled with copper filings and closed by two rings of brass, or by two corks through which two copper conductors pass, and a cell is introduced into the circuit, with the aid of a galvanometer or telephone, it may be shown:

"First, if the copper powder is compressed in the tube it becomes a very good conductor.

"Second, if the copper powder is not compressed, the current will pass.

"The second case is interesting, and, having noted this peculiarity, I thought to study exactly the quantity of filings which limits the conductivity of tubes.



ONESTI COHERER—1884.

"For this purpose I made a small apparatus* in which a small glass tube, *a*, is closed at one end by a brass ring, *o*, and at the other end by a screwed movable ring, *h*. The tube can turn about a horizontal shaft (*b*) supported by two brass columns (*d*) fixed on a wooden board. The fixed ring, *c*, is rigidly connected, not only to the tube, but also to the part, *b*, of the shaft. The movable cap, *h*, ends in a conical centre which turns in a hole drilled in the end of the screw and forms in this way the other part of the shaft.

"The calibrated glass tube is 35 millimeters long and has an internal diameter of 10 millimeters. Two copper wires soldered to the brass columns dip into two mercury cups, which disposition allows of operation always under the same conditions.

"With great care I filled the small tube with filings, at the same time shaking the tube and striking it gently while in vertical position. Without such precautions it is easy to have errors. To make sure that the conductivity was really interrupted, I dipped the two terminals of the circuit† into a mercury cup. Having in this way closed the circuit several times, I was struck by the fact that upon dipping again one of the terminals in the other mercury cup, a current flowed, and that the more numerous the interruptions in the first cup, the more the intensity of the current was increased (or the more the resistance of the filings diminished). One revolution or less of the small tube was sufficient to destroy this effect."

The reader can thus see that, as in a coherer, an electric wave due to the breakage of current gave to the filing a conducting power, while mechanical motion suppressed it.

Prof. Calzecchi, in the same article, described some further experiments and determined the weight and density of the filings of

* For the interest of the reader I illustrate diagrammatically this apparatus by a figure which, probably for the sake of economy, was not published in the Italian journal.

† The circuit made was of a galvanometer or telephone, a primary cell and the glass tube.

numerous metals (zinc, lead, copper, iron, brass, bronze, German silver) at the limits when their conductivity ceases, but this is not so important as a striking remark in the paper of which I shall endeavor to give a literal translation.

"*The conductivity of the various filings can be acquired by establishing* an electrical contact with one of the conductors of an Holtz or other electrostatic machine. The conductivity acquired in this way is such as not only to last a long time, but destroys partially the resistance of the filings. *Submitting the apparatus* to the *action* of the *induction* of an *electrified body, the filings again* behave *similarly but not so strongly.*"

As the reader can see, Prof. Calzecchi Onesti had in 1884—that is to say, six years before Prof. Branly—invented and studied the coherer. Prof. Onesti has in the final part of the article studied very thoroughly the various phenomena.

One year later, in 1885 (issue of March 2), Prof. Calzecchi wrote that the phenomenon was due mainly to the presence of the telephone, which initially was used only for detecting the current; and that substituting for the telephone any other coil having an inductance, the phenomenon showed itself again, but disappeared when the coil was taken away. Thus Prof. Onesti was led to point out that the phenomenon was due to the extra current due to the inductance of the coil. (*Nuovo Cimento*, page 39, March 2, 1885.) In this article he described the production of electric waves by interruptions given by the vibrations of an electrical bell, and pointed out several conclusions, among which the following is the most important:

"A certain number of interruptions of the circuit, an induced current, a connection with an electrified body, an electrostatic discharge, are sufficient to give the filings a conductivity not before possessed."

In 1886 (March 23) Prof. Onesti described also a detector of seismical movements, consisting of a tube containing brass filings, the conductivity of which caused by electrical waves, ceased when subjected to small earth movements.

I have endeavored to translate and partly to resume the most important points of the work of the Italian professor. The reader who desires to investigate the matter further is referred to the original papers in the files of the Italian journal.

I think to have demonstrated that in 1884 (six years before Branly) Prof. Calzecchi Onesti not only invented the coherer, but studied scientifically its behavior and the causes of the phenomenon, and that he had in 1886 made a practical application of the apparatus.

Prof. Onesti's work was known and quoted in *Wiedemann's Annalen* (N. F. XXVIII., 1886) by Prof. Auerbach, and, having originally been printed in one of the oldest and best-known European scientific journals, there is no doubt that none but he has the right to be considered the inventor of the coherer.

Movements in the Telephone Field.

It is announced from Philadelphia that Messrs. W. C. Whitney, T. F. Ryan, A. N. Brady, P. A. B. Widener, W. L. Elkins and T. Dolan have all withdrawn from the new independent Telephone, Telegraph & Cable Company. Just what this "withdrawal" amounts to is not plain, but it is thought that some of those named above will still retain an interest, although having nothing to do with the management, which will be left as before in the hands of Mr. Martin Maloney, Mr. W. J. Latta and Mr. G. W. Beers. The abstention of Mr. Whitney from active participation was noted last week in these columns. Mr. Maloney has been devoting his time and energies to the scheme for some time past, and has made it peculiarly his own. The reasons for the apparent withdrawal of those who have been his friends and associates in so many other enterprises are that conflicts and antagonisms of a serious nature in various fields are being aroused, and that the complications are such as it is desirable to avoid. The work of the company in making alliances and connections is going on actively.

As to New York City and Brooklyn, it is stated that the company has secured control of the New York & Eastern Telephone & Telegraph Co. This latter company, which was organized by S. H. Mildenburg, and is capitalized at $5,000,000, possesses a very valuable franchise in Brooklyn Borough to lay wires and string them along the same posts that the fire department uses for its line connections. It is understood that there is some dispute between Mr. Mildenburg and the People's Telephone Corporation and that a lawsuit impends as to stock.

The close relations between the Telephone, Telegraph & Cable Company and the Knickerbocker Telephone Company are indicated by the fact that the latter has now moved to 100 Broadway, so that both are now in direct touch under the same roof. Steps have been taken to organize an engineering and expert staff, prepare plans and estimates, study the subway question and make other forward movements, the result of which should soon be apparent.

Outside of New York, work is also going on. Another article in this issue describes the conditions in New England. A special despatch from Albany, N. Y., of Nov. 24 says. "The Rochester Telephone Company, with a capital of $400,000, was incorporated to-day with the Secretary of State. The general route of the company, besides operating in Rochester, will include Syracuse, Utica, Oswego, Watertown, Ogdensburg, Buffalo, Niagara Falls, Mayville, Corning, Elmira and Binghamton. The directors are former Secretary of State Frederick Cook, Thomas W. Finucane, George W. Archer, Albrecht Voght, H. Wheeler, Gustave Erbe, George R. Fuller, Jacob Gerling, J. Foster Wagner, Edward W. Peck, Horace C. Brewster, Willard R. Spader, V. Moreau Smith, Ezra M. Higgins, of Rochester; Eugene H. Satterlee, Pittsford, Monroe County. It is said here that the Rochester Telephone Company is the last of the independent corporations to be formed, and that the plans are now complete for a combination of the independent companies that have been quietly formed so as to cover the entire state from New York to Buffalo and Niagara Falls."

As to Ohio, important work is reported to be going on, and Mr. H. A. Everett, who is at the head of the large independent system in Cleveland, was in New York in regard to the subject last week.

From Pennsylvania it is reported that negotiations are now on foot whereby all the independent telephones in the Pittsburg district will be consolidated and gathered into the fold of the Federal Company. President Frederick DeLand has stated that one of the first steps in the operation of the Federal Telephone Company will be the establishment of exchanges in all the cities and towns in the vicinity of Pittsburg. He has denied that there is any connection between his company and the Telephone, Telegraph & Cable Company.

Electric Railways in England.

There is unusual activity in London among American agents of electric railway promoters and builders, in view of what is looked upon as a favorable outlook for the granting of concessions to Americans by Parliament. Heretofore they have had little success in securing franchises, but it is said that the government may look more favorably upon the American plans and grant the desired concessions.

In Dover, Del., on November 11, there were filed two separate charters, from the nature of which it is thought that combinations of English and American capital are ready to undertake the construction of tramways in Great Britain. One concern is known as the London Electric Tramway Construction & Maintenance Company, with a capital stock of $2,500,000. The other corporation is the British Electric Street Tramway Company, with a capital stock of $5,000,000, and with power to construct and operate trolley lines in Great Britain and her colonies. By its charter the company expects to begin operating at Dover.

Albert L. Johnson, of Brooklyn, said that he was making surveys and maps with specifications of proposed electrical tramways in and about London for an American syndicate, which hoped to secure a franchise. The work was commenced last May, and has been under way ever since.

"American street railway men look towards England for a profitable field of operations," said Mr. Johnson, "because steam cars make the long hauls and horse cars and stages still do the short ones. The masses in the thickly-populated country and suburban districts have no resort anything near a medium. England, because it is a free-trade country, supports the greatest traders in the world, and within a step of St. Paul's, one can get in connection with every quarter of the globe, yet from that same spot the same person would have difficulty in reaching nearby points in and around London. There are no trolley roads like ours traversing the city, and connections between towns and suburbs are poorer. For the distance you can travel here on five cents it would cost you sixteen cents in London.

"American capitalists believe that a well-regulated trolley road through a thickly-settled bit of English country cannot be beaten as an investment. But franchises are hard to get. Under English law, a trolley franchise can be granted only in May or November. The municipalities like to control these franchises. If they don't care about owning them, they lease them to individuals or companies, by which more money is made by the towns.

"Street railway franchises are much harder to secure in London than in New York. When they are granted in England they are only good for twenty-one years. Englishmen are not so far advanced as Americans in street-railroad construction, and that probably is another reason why the government is not disposed to grant valuable concessions to foreigners. However, this fails to impress Americans. Not only are the capitalists over there, but the American manufacturers of electrical supplies are there and building. But one can never tell what there is in it. It all depends upon those franchises."

Telephone Company Incorporated in Delaware.

The Delaware Trust Company, of Wilmington, Del., has filed at Dover, Del., articles of incorporation for the "Central Telephone & Telegraph Company," which proposes to run lines through the principal counties of Pennsylvania, and has an authorized capital of $125,000, which will probably be largely increased in the near future. The incorporators are W. D. Bannard, of Philadelphia; William C. Mayne, of Bristol, Pa., and Gardner W. Kimball, of Wilmington, Del. Mr. Bannard has been for a number of years actively interested in telephone companies throughout the country and has only recently organized companies in Elmira and Binghamton, New York. Mr. William C. Mayne is a prominent Philadelphia lawyer and is largely interested in the project. Mr. Gardner W. Kimball, the third incorporator, is the secretary of the Delaware Trust Company, through which the charter was secured. A provision in the Delaware law which exempts telephone companies, operating wholly outside the State of Delaware, from the payment of annual franchise taxes, has caused this company as well as several other telephone companies to file their charters in Delaware in preference to Pennsylvania and other States.

CURRENT NEWS AND NOTES.

NEW TYPE OF COHERER.—MM. Blondel and Dobkevitch have developed a new type of coherer, which is claimed to be more sensitive than the Branly tube and will last longer. A high vacuum is maintained in the tube, and in order to renew the filings, which deteriorate with use, a pocket attachment contains a reserve supply of filings, part of which may from time to time be introduced into the tube proper by a simple manipulation.

ELECTRICAL PRODUCTION OF OXYGEN AND HYDROGEN.—The Société Anonyme l'Oxlydrique, of Brussels, has commercially applied the electrical process for producing oxygen and hydrogen, which gases it delivers chemically pure in steel cylinders of standard size, compressed to 120 atmospheres. Among the applications for which the gas is sold is the Drummond light, soldering of various kinds and welding, the latter process being applied to locomotive boiler tubes and other work of similar character.

THESIS WORK AT THE UNIVERSITY OF ILLINOIS.—The subjects for theses of the present senior class in the department of electrical engineering in the University of Illinois will include the design and construction of a motor-generator; test of a rotary converter and performance as a synchronous motor; design and experimental study of transformers of various types and windings; theoretical and experimental investigation of induction machines; design and experimental working of a polyphase transmission line. Some of these investigations will be made on the new and specially designed equipment now being installed in the electrical engineering laboratory of the university.

HANDLING THE MAILS.—The annual report of Second Assistant Postmaster General Shallenberger, just issued, urges the handling of mails by pneumatic tubes in congested centres of population. Recommendation is made for $500,000 for extension of the pneumatic service, together with $225,000 for the present tube systems for the next fiscal year. The department has invited proposals for carrying mail by automobiles between the post office in Chicago and two postal stations in the business centre, and also for the same service in screen wagons, one of these methods to be selected later. If results favorable to the automobile are gained from this test, it is probable, says the report, that automobiles eventually will supersede screen wagon service in many large cities, and also take the place of electric cars for carrying mails where automobiles are permitted to run rapidly.

NEW TYPE OF PRIMARY BATTERY.—A patent was granted Nov. 21 to Charles B. Schoenmehl on the construction of the negative element of a primary battery. A perforated corrugated cylinder of copper forms a receptacle for the depolarizing agent. This receptacle or basket is provided with a detachable top and bottom secured thereto by means of vertical rods running through the basket. These top and bottom pieces are each provided with a flange which engages the outer surface of the corrugations of the basket and firmly retains them in relative positions at all times. In pockets formed between the lower flange and the inner part of the corrugations are inserted insulating blocks, and on these blocks rest the cylindrical zinc surrounding the basket.

A GERMAN AFRICAN CABLE.—The movement in favor of German cables is growing. Besides a direct cable to New York, now under way, the Government proposes soon to lay one to the German colonies in Africa, via the Azores, with a terminus at Swakopmund. Thence the line will cross to German East Africa, touching at Togo, Cameroons. The *Kreuz-Zeitung* says: "One lesson which Germany has learned from the present war is that we must have an African cable of our own. Perhaps it is possible to combine in the matter with some other power, say France." Many complaints appear in the papers regarding the British cable service to and from Africa since the war began. A number of firms have complained to Prince Hohenlohe, and have asked him to obtain damages from Great Britain. The press is advocating independent German cables.

ALTERNATING-CURRENT FIELD WINDING.—In a patent issued Nov. 21 to Conrad N. Rosenquist, of Birmingham, England, on a form of single-phase synchronous motor field, is described, applying to those alternating-current motors in which two sets of windings are provided on the field magnet, one for starting up and using alternating current and the other for normal service and using direct current. The usual polar projections are each notched in the middle and on the two supplementary poles thus formed is the starting winding, the main winding being on the polar projection as a whole. The double starting winding on each main pole neutralizes the secondary current that otherwise would be set up in the main field winding. When speed is obtained by means of the auxiliary winding, it is cut out and the main or direct current winding cut in. An automatic means of performing the latter operation is also described in the patent.

ELECTRIC TRACTION AT PARIS.—The subject of electric traction is assuming a prominent position in Paris at the present moment, and there is much speculation as to whether the Metropolitan line from Vincennes to Port Maillot will be finished in time for the exposition. This line has a total length of about 7 miles of underground road with 23 stations. Over six miles of the road has been constructed and 21 stations are finished. It is therefore certain that the entire work will be ended by February of next year. The Creusot Works will at once begin the electrical installation. The principal power house will be installed at Bercy and ground has already been broken for it. A series of underground tramway lines are also under construction, which will unite the suburbs and penetrate to the centre of Paris. This work is under way, but none of it is yet near completion. The Société Electrique du Secteur de la Rive Gauche de Paris, having obtained a concession for two lines of tramways, one from Boulogne to Vincennes and the other from Montreuil to Boulogne, has just transferred it to another company, receiving in payment 910,000 francs. The Compagnie Generale de Traction de Paris recently offered to the General Omnibus Company all of its seventeen horse car lines for electrical transformation, the consideration asked being a payment per carriage mile until the end of its concession in 1910, less than was earned in 1898 by its horse cars. Notwithstanding the advantageous nature of this proposition, it has not yet been accepted.

ANTISEPTIC MOUTHPIECE FOR TELEPHONES.—A patent was issued Nov. 21 to George W. Van Alstine on an antiseptic mouthpiece for telephone transmitters, consisting of a cup formed of an antiseptic gauze fitted to the rim of the mouthpiece, the cup portion projecting inwardly.

A RAILWAY MOTOR MOUNTING.—In a patent granted Nov. 21 to John L. Creveling, a singular method is described for mounting an electric railway motor. The motor is pendulously supported from the truck. On extensions of the armature shaft are two smooth pulleys which bear against similar smooth pulleys on the car axle, the object of this arrangement being to preserve a true alignment of the armature shaft with the axle and thus enable the gears to mesh properly. A spring plunger presses against the rear of the motor case in order to keep the gears engaged.

TELEPHONE TRANSMITTER.—In a patent granted Nov. 21 to Ellis F. Frost, a telephone transmitter is described which is stated to possess all the resonant and sensitive qualities of the Blake transmitter type, combined with the desirable qualities of the Hunning type, but avoiding the packing incident to the latter. The diaphragm carries a disk or piston of conducting material such as carbon, which enters a cylindrical bore in a block behind the diaphragm. At the opposite end of this cylindrical chamber is a carbon plug extending to about the middle of the chamber, and with its end truncated. The space in the chamber between the piston attached to the diaphragm and the beveled surface of the plug is about half filled with granular carbon.

NEW TYPE OF ARMATURE.—A new type of armature is described in a patent issued Nov. 21 to Conrad N. Rosenquist, of Birmingham, England. The armature consists of two or more separate cores on the same shaft, each supplied with an equal number of slots, or perforations near the outer edge, the slots in one core being uniformly displaced with relation to those in another core. The windings in the slots are connected successively in series with the commutator segments in such a way that one end of each coil is joined at the commutator end of another coil on the same core. It is claimed that by this construction the distance between the coils on each core is increased with consequent increase of effective polar surface of the core without diminishing the total number of coils or commutator bars for the entire armature; furthermore, that the number of slots in any cover when, say, three cores are used, will only be one-third of the whole number of armature coils.

FORMING STORAGE BATTERY PLATES.—A patent was issued Nov. 21 to Henry Leitner, of London, England, on a method for forming storage battery plates under pressure. The positive and negative plates are placed in alternate layers in a strong box and separated from each other by a layer of porous material such as porcelain, the latter having longitudinal grooves to admit of circulation of the electrolyte into the interior. The box is lined with thick, soft rubber, to admit of some give, and grooved wooden blocks are fitted to prevent the plates from expanding longitudinally. After the plates are thus secured the box is closed by a lid, which by means of a screw is pressed strongly down on the contents. As the charging proceeds, the positive plates tend to expand, but owing to the rigid confinement of the sides and top and bottom this expansion can only be in thickness as allowed by rubber pads at the top and bottom.

UNDERGROUND FOR LONDON.—A special despatch from London of November 25 says: The working-class housing difficulty is becoming acute in London, owing to the extensive street improvements being executed by the county council. Working-class tenants displaced by the cutting of a new street from Holborn to the Strand will be provided for in new flat dwellings specially erected at a cost of $1,150,000, but municipal reformers recognize the superior advantages of enabling workmen to live in the country close to London. A scheme is being matured to start several working-class village settlements conveniently situated around the metropolis. A great obstacle hitherto preventing workmen from living outside was the slow, costly and inconvenient bus, tram and train services. The county council now controls the tramways, and is inviting tenders for supplying the whole tramway system of the metropolis with underground electric traction. The new cars will travel 20 per cent. faster with a 50 per cent. saving in fares.

THREE-PHASE WATT-HOUR METER.—A patent was issued Nov. 21 to Julius A. Mollinger, of Nuremberg, Germany, on a motor wattmeter for three-phase alternating current. The specification says the investigations made by Behn-Eschenberg and Shallenberger have shown that the total energy consumed in the three-phase system, whatever may be the load, can be measured by two meters of the induction type so arranged that the series coil of the first meter is inserted in one branch of the main line and the series coil of the second meter in a second branch; the shunt field magnet of the first meter being in quadrature between the first and third mains and the shunt field magnet of the second meter in quadrature between the second and third mains. The present invention has for its object the giving of a proper phase relation to the shunt magnet fields of such a meter system. This is done by arranging the shunt field magnets of the two meters so that their phase displacement is 60 degrees; and combining with them a choking coil having a phase displacement of 60 degrees, the arrangement being such that the shunt magnet coils are connected at one end to all of the mains and at the other end to an intermediate point of the mains. Calling the three mains of the circuit *A*, *B* and *C*, one series coil is in the main, *A*, and the other in the main, *B*. The two shunt coils have a choking coil in common, one end of which is connected to main, *A*. One of the leads from the other end passes to the shunt coil of *A*, the other side of the latter being connected to the main, *C*. Similarly, the shunt coil of *B* is between the common choking coil and the main, *B*. As an example of the values of the several coils giving a proper relation, the common choking coil may have a resistance of 70.6 ohms and an inductance of 2.56 henrys; the shunt coil of *A* a resistance of 800 ohms and an inductance of 3 henrys, and the shunt coil of *B* a resistance of 430 ohms and an inductance of 2.8 henrys. The mathematical theory of this type of meter is included in the specification.

THE DESIGN OF FUSIBLE CUTOUTS.—In a paper read before the November meeting of the Chicago Electrical Association on "The Design of Fusible Cutouts," Mr. H. H. Glover treated the subject from the standpoint of the fire underwriter. The subject of glazed and unglazed fused bases is one which it is stated opens up a large field for discussion. A glaze with an excessive coefficient of expansion will in time become full of cracks, which will retain moisture and offer paths of comparatively low resistance. The use of lead in the glaze usually results in a mettalic film upon the blowing of a fuse. The parts of a cutout about the fuse should therefore preferably be left unglazed. A rather restricted air space at the ends of the block and an enlarged air chamber with vents near the centre gives most reliable action. Connections for currents up to 25 amperes should be made by terminals provided with screws or washers with a turned-up lug on both sides to prevent the wire from slipping out. Above 25 amperes connections should be made with lugs firmly screwed to the terminals on the flat surface and into which the conducting wires can be soldered. As to lengths of fuse, the following are given as having been indicated by careful experiments: For 3 to 5 amperes, 2½ inches; 10 to 15 amperes, 3½ inches; 20 amperes, 4 inches, or an increase of ½-inch for each increase of 5 amperes. While these lengths seem excessive when judged by common practice, it is stated that the data of experiments clearly indicate their desirability. The enclosed type of fuse is referred to as a fuse that will operate at a predetermined point at any overload and can be relied upon within very close limits. For sudden, heavy overloads a multiple fuse or several small wires is much more sensitive than a large wire of the same capacity, and for the same reason a thin, flat ribbon may be considered more reliable than a round fuse.

LETTERS TO THE EDITORS.

Grounding of Low Tension Circuits.

To the Editors of Electrical World and Engineer:

Sirs:—In your issue of November 11, there appeared an article by Mr. W. L. R. Emmet, on the "Grounding of Low Tension Circuits," and the subject was also treated editorially. In view of the deductions drawn, it is believed the following views supplementing my letter published in your last issue may be of interest.

It is stated by Mr. Emmet that "there is no conductor connected with an ordinary low tension system of wiring, which would carry

a current sufficient to cause such potential distributions as the writers of this article predict." The argument on which this statement is based is essentially that "the resistance of transformer secondaries and dynamo armatures are ordinarily such that the full load current which they supply does not cause a drop of potential in the armature or secondary greater than two per cent. of the normal voltage. Consequently, in order that the drop in potential across the terminals of such apparatus may give rise to dangerous potential differences, it is necessary that a current be received from the high tension source, which is many times the full load low tension current."

This is granted as far as the generator terminals are concerned, for it would hardly be possible to greatly increase the potential difference to earth at a low tension grounded generator by a high tension cross. But this is not the point at issue; the question is can any other portion of the system be raised to a dangerous potential? To answer this question it is necessary to find out whether all portions of a low tension grounded network have the low resistance implied by Mr. Emmet.

Let us assume a low tension network with 2000 amperes normal flow of current fed by 10 feeders carrying equal loads, and assume the loss on the feeders to be 10 per cent. According to Mr. Emmet the armature would have about .001 ohm resistance, and the feeders according to our assumption about .005 of an ohm resistance, and the translating devices taken together would be about 05 of an ohm, or about 10 times the resistance of the feeders. These would be therefore the proper resistances to use if all the feeder ends were at one point and bussed, and fed all the lamps at the same point.

In practice, however, the feeders are radii feeding an extended network. There are resistances between the feeder terminals and between each translating device. If each feeder were isolated and fed its 200 amperes to its isolated translating devices, then the resistances would be, generator, .001 ohm; feeder, .05 ohm, and translating devices, .5 ohm. Now, since the feeders are connected together by the network of mains, the resistance at any feeder end through generator to earth lies between the two values given above, .005 and .051 ohms. The net resistance at the feeder ends to the grounded leg of the system has in parallel with these values some value lying between .05 and .5 ohms, representing the translating devices.

The resistance to earth from any point on the network of mains will necessarily have an increased value over the resistance at the feeder ends, varying through a wide range as the distance increases from the feeder ends. An approximate idea of this resistance may be obtained by placing a load at some point desired and noting the fall of potential caused thereby. This consequent fall of potential divided by the applied load will be the resistance from the point through the generator to earth. In parallel with this resistance of the network through generator will be the resistance through translating devices. It is assumed that the wires of a network are usually laid out with the resistance in ratio of about 1 to 10 with the translating devices; therefore, the path to earth at any point over the translating devices may be considered to be 10 times greater than through the network and generator to earth.

To illustrate, if an additional load of 100 amperes be thrown on to some point of the network, and causes an increased fall of 10 volts, the resistance of the network through generator to earth will be .1 ohm. In parallel with this will be the resistance of the lamps about 1 ohm. A crossing high tension current at this point would have an approximate resistance of .09 of an ohm to earth. The crossing high tension feeder may vary from appreciably no resistance to a comparatively high resistance. If the resistance is the same, at 500 volts the fall of the potential over high and low tension circuits would be the same, and the low tension system at the point crossed would be raised 250 volts above its normal. This potential would decrease as the generator is approached, until at the generator the rise would be inappreciable. Within a certain area, therefore, around the point of cross, there would be a dangerous rise of potential on the low tension system, destructive to lamps, fuses and insulation.

The current flowing through translating devices is proportional to the voltage impressed, and the blowing of fuses on any installation from increased current through the translating devices depends upon the number of lamps in use at the time. Should the insulation of the wires in fixtures, etc., break down, blowing of fuses from this cause and destructive arcs would take place. It is therefore erroneous to assume, as does Mr. Emmet, that as all the fuses of a system are in parallel, only an enormous current would blow any of them. It is seen that when a cross occurs the rise of potential is localized, and every such rise of potential has a danger area, within which the fuses may blow irrespective of those outside of this area. In many instances the flow of current may cause the crossing wires to burn in two; but it must be remembered that for the wires to be fused, the current must have passed through its varios circuits to earth.

The above illustration, while it may not be in exact conformity with all systems, will serve to illustrate a general condition, which is a feature of every low tension system; notably that every point thereon has an individual resistance to earth. And from what has been shown it is submitted that the permanent grounding of one leg of a system, even should this ground be assumed to be such as it is advocated, will not prevent an increased potential above the earth under many conditions arising in practice.

The conditions under which a grounded system may fail to protect are:

(a) When the "permanent grounds" have or acquire an appreciable resistance.

(b) When the resistance to earth at the point of cross bears such relation to the resistance to earth over the high tension circuit that this point acquires a dangerous potential above the earth.

In view of these inherent defects in the advocated grounded system it cannot be considered to have much advantage of the present construction.

Permit me also to take exception to a sentence in your editorial comment referring to this question, as follows: "Nothing can be simpler or more reliable than a permanent ground behind a fuse."

It seems to me that fuses cannot be considered suitable cutouts on an increase of potential. Their operation is dependent on an excess flow of current which takes place due to the current having passed through either translating devices or from a breakdown of insulation. This action is always the result and not the antecedent or preventive of such flow, and generally increases the damage. An increase of potential might take place on a house circuit where an insufficient number of lamps are turned on to blow the house fuses; and a consequent breakdown of insulation may take place in addition to the destruction of the lamps. A proper cutout for such conditions must operate on the potential difference between the wires and earth, and must be independent of any flow over the house fuses, as the circuit should be relieved of the high potential before it has an opportunity to break down insulation or blow any fuses.

NEW ORLEANS, LA. WARREN B. REED.

Professional Degrees.

To the Editors of Electrical World and Engineer:

Sirs:—Referring to Mr. Rimanoczy's inquiries concerning professional degrees, I would state as my opinion that the degrees M. E., E. E., C. E., should be granted after one year of post-graduate work, and a thesis should be required. As to the weight of a degree, the profession judges the man chiefly upon his merits and not because of the degrees which he holds.

Engineering degrees stand upon the same legal footing as the degree M. D. The holders of both kinds of degrees need clients or patients not merely for the fees associated with them, but for the experience which will accompany or follow them.

SAMUEL SHELDON.

POLYTECHNIC INSTITUTE, BROOKLYN, N. Y.

To the Editors of Electrical World and Engineer:

Sirs:—The question which Mr. Rimanoczy has brought up, as to the conditions under which engineering degrees should be granted, is at present in such an unsettled state, and there are so many and various conditions to be met by different institutions that there is, it seems to me, good reason for avoiding a too positive or dogmatic expression of opinion. Personally, I am inclined to think that professional study should be left as far as possible to a post graduate course; this is the position now taken by some of our best medical schools, which practically require for entrance a college education of a definite character suitable as a preparation for the study of medicine. While it is impossible for all the men who are to be physicians to spend so much time in preparation, yet I believe that it will be to the great advantage of the medical profession to have within it a body of men who have passed

through such a course of training; and it seems to me desirable that the larger and stronger institutions of the country should do this work in engineering as well as in the other professions.

I cannot regard as successful the attempt which is made in many places to combine a college course with a professional training, and I do not believe it is possible to give to the average student, in four years, a liberal education—to teach him French, German, mathematics, English literature and what not—and at the same time to equip him for immediate entrance into engineering or any other profession. Under the elective system a college course may well be made *preparatory* to the profession the student expects to enter; but, in the professional course itself, I believe that, for good results, the general culture idea must be left out in engineering as in law or medicine.

As to the desirability of outside work as a requirement for an engineering degree, it seems to me that it is really a matter of definition and depends upon what the degree is commonly accepted as meaning. Every one knows that a man just out of school, no matter what degrees he may hold, is not a finished and complete engineer or doctor or lawyer; but if the degree is understood to mean that he has had the necessary school-training to enable him to become a competent engineer under the teaching of experience, I can see no harm in granting it at the end of his school-course. This plan has the advantage that, under it, the authorities of the school are not required to certify to work which has not been done under their direct supervision, and of which they can have only an imperfect knowledge.

HENRY A. BUMSTEAD.
YALE UNIVERSITY, NEW HAVEN, CONN.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Rotary Converters.—TACHIHARA.—A continuation of the discussion noticed in the Digest Nov. 25. Nakamara considers that the expression $i = I \sin(\phi - \theta)$ for the equation of the current in a certain coil of rotary transformer, might better be written $i = I \sin\phi$. The present writer claims that there is a misunderstanding on both sides in the discussion concerning the position of the coil; he claims that the two expressions can be used indifferently, but in considering the combined direct and alternating current, there is some phase difference, and it is therefore better to use the first of the two formulas, contrary to the recommendations of Nakamara.—*Elec. Friend.* (Japan), Oct. 15.

LIGHTS AND LIGHTING.

Nernst Lamp.—A description taken from an English patent specification, of a joint for connecting the metallic conductor with the electrolytic one. It is made with a plastic mass formed of metallic oxides and a flux, which is applied around the point of contact and then "subjected to the action of an incandescent body." Such a joint becomes a conductor only at the higher temperatures, at which its conductivity is equal to that of the electrolytic conductor. The flux may be replaced by an aqueous solution of salts of oxides, or the latter may be used alone, and if applied in several layers, a good joint may be obtained. The following proportions are said to give good results: 93.7 parts of oxide of thorium, 3 of oxide of zirconium, 3 of oxide of yttrium and 3 of oxide of cerium, or 80 parts of oxide of thorium and 20 of oxide of yttrium; four other mixtures are given.—*L'Eclairage Elec.*, Nov. 4.

Osmium Filaments for Incandescent Lamps.—MORTON.—In a paper on recent developments in artificial illumination, read before the American Gas Light Association, he mentions the Welsbach method of making osmium filaments. This metal, which is somewhat like platinum, but has a still higher resistance to heat, was long ago thought to be well suited for filaments, but all attempts to handle osmium or to draw it into wire failed. Welsbach takes a salt of osmium, saturates a thread with it, then burns away the thread in a certain atmosphere so as not to affect the osmium itself; this leaves a fine filament of osmium in a thin and elastic condition. It is believed that the osmium filament can be raised to a temperature several degrees higher than carbon, and a very few degrees at that point will make a very great difference in the amount of light emitted.—*Prog. Age*, Nov. 15.

Distance Between the Carbons in Arc Lamps.—An account of a series of tests made to find with precision the variation of the distance between the carbons in arc lamps, when the voltage is constant. The results are given in diagrams and show that there is a great and irregular variation, so that it is impossible to adjust arc lamps by the eye with the aid of a dark glass. A table gives the distances of the carbons of different makers for currents varying between 2.5 and 12 amp., at a constant pressure of 40 volts and shows large differences.—*Elek. Anz.*, Oct. 22.

200-Volt Low Candle-Power Lamps.—GIBBINGS.—A communication pointing out that 8-cp lamps at 200-300 volts have proved to be a commercial success in Bradford, and are as good as lamps of 16 or higher candle-power.—Lond. *Elec.*, Nov. 10.

POWER

Electricity on Board Ship.—WATT.—In an paper on novelties in ship fittings, read before the Society of Naval Architects, he describes a new watertight bulkhead door which is operated by electric instead of hydraulic power. A 1-hp compound-wound motor is used, of the short shunt type; for raising the door only the series coils are in circuit, giving quick and easy starting, while for closing the door where it may be necessary to cut through coal, the shunt and series coils are both in circuit. The arrangement of the switches is described and the bulkhead door is illustrated.—*Eng. News*, Nov. 23.

REFERENCES.

Electric Motors for Workshops.—RAWORTH.—Three appendices to his paper, which was noticed in the Digest Nov. 25. The first deals with the power required to drive shafting and various types of machines, and gives Benjamin's figures for the losses in shafting based upon the conditions existing in twelve different shops in the United States, and two other tables for the details of the power required to drive a 24-in. saw frame and for those required by shipyard and other machine tools when running under light and heavy loads. References are also given to some other similar tables. A second appendix gives a list of English firms using electrically driven machines; in a third appendix the results of efficiency tests of various motors are given in the form of tables and diagrams.—Lond. *Elec.*, Nov. 10; a shorter abstract in Lond. *Elec. Eng.*, Nov. 10. The discussion which followed the paper is abstracted at some length and referred to in a separate editorial in Lond. *Elec. Rev.*, Nov. 10. A reprint of this paper is begun in *El'ty*, Nov. 22.

Engines.—PARSONS.—A long abstract of his presidential address to the English Institution of Junior Engineers. He explains the principle by which the energy derived from the heat of the sun may be changed into work. The different general types of heat engines are briefly discussed and the principle of the steam turbine is described.—Lond. *Elec., Ind. and Iron*, Nov. 10; briefly abstracted in Lond. *Elec. Eng.*, Nov. 10; the portion on steam turbines is given at some length with numerical data in Lond. *Elec. Rev.*, Nov. 10.

Parsons' Steam Turbines.—An illustrated description of C. A. Parson & Co.'s Heaton Works. The work at present in hand there amounts to a total of 9000-kw. Some of the machines now under construction are described and illustrated.—Lond. *Elec. Rev.*, Nov. 10.

Hiroshina Transmission Plant.—A description of this Japanese three-phase, 11,000-volt transmission plant for power and lighting.—*Elec. Friend* (Japan), Aug. 15.

Electric Energy in Belgium.—GERARD.—The paper in full, an abstract of which was noticed in the Digest Sept. 30.—*L'Elec.*, Nov. 11.

TRACTION

Electricity for Local Railways.—KRIZIK.—A long account of the trial made on a local railway from Nusle to Mechenic, in Bohemia,

the length of the line being 14½ miles. An accumulator motor car, like the ordinary tramway cars, was used; the battery consisted of 280 Tudor cells and had a capacity of 20 amp. hours at a discharge of 20 amp., 50 amp. being the safe limit. The average current was 27 to 29 amp. For charging the battery, stations were erected in Nusle and in Koenigsaal. The particulars of the tests are given in two tables and a diagram. Although the line had heavy grades, the trial appears to have been a success. Accumulator traction either with accumulator motor cars or with accumulator locomotives is recommended for short lines with light grades between towns where a large traffic, at frequent intervals, is required; the stations for recharging the batteries should be at the ends of the line. The overhead trolley system is recommended for longer lines with heavy grades; a combination of both systems for short lines with heavy grades; the station for recharging the batteries should then be located at the top of the highest grade.—*Zeit. fuer Elek.*, Oct. 29.

Marseilles Tramways.—An article on the projected extension of the electric tramways in Marseilles, which was the first French city to adopt the American trolley in 1892 for about one-tenth of its lines. Now electric traction is to be installed on the whole network, the price for any trip being 2 cents. As the rails will be used for the return currents, the rule fixed by the government is to be complied with, that the maximum drop of voltage between any two points of the return circuit must not exceed 5 volts; a recent decree of the government limits the drop to 1.6 volts per mile. In the power house outside of the city there are six 1000-kw dynamos directly coupled to six steam engines, each of 1500-hp effective; they will generate three-phase alternating current at 5000 volts, frequency 25. The current will be transmitted to six substations of a total of 4900-kw and there reduced to 340 volts; synchronous converters transform this into continuous current of 550 volts.—*L'Ind. Elec.*, Nov. 10.

REFERENCES.

Electrical Installations in Australia.—A short article, taken from an official report, on electric traction work in Sydney. The tramway power house also furnishes current for a pumping station raising the sewage from a low level area up to a gravitation sewer on the higher level. One of the electric motors for air-compressors is illustrated.—Lond. *Elec. Eng.*, Nov. 10.

City and South London Railway.—A map of the route with the extensions under construction.—*El'ty*, Nov. 22.

Hungary.—A statistical table of the traffic of the Hungarian electric tramways from July to September, 1899, and a comparison of the traffic and the earnings in 1899 and 1898.—*Zeit.. fuer Elek.*, Nov. 5.

Surface Contact System at Tours.—An illustrated description of this installation, where the Diatta system is used, as described in the Digest May 27, June 10, July 1, 22.—*Sc. Amer. Sup.*, Nov. 25.

Tramway Cars.—Sykes.—An illustrated description of the Electric Railway & Tramway Carriage Works in Preston, England.—Lond. *Elec. Eng.*, Nov. 10.

Automobile Accumulators.—Bainville.—A German translation in full, with illustrations and tables, of the French articles on the recent accumulator tests, noticed in the Digest Sept. 23, under Electrochemistry, Oct. 14, under Traction.—*Elek. Anz.*, Oct. 22, Nov. 2.

Installations, Systems and Appliances.

Alternating-Direct Current Station Work.—An illustrated description of recent extensions of the combined system of the Chicago Edison Co. Three-phase alternating current is transmitted from the Harrison Street station to the Twenty-seventh Street station, where it is changed into direct current and then distributed by the three-wire system. The new equipment of the latter station is described; besides 12 transformers and 5 synchronous converters, it contains a storage battery of 150 cells and 4000 amp-hours capacity at an eight-hour discharge rate. To save space, the cells are placed in two rooms one above the other, the upper room holding the positive side of the battery and the lower room the negative. To accommodate the increase of the company's business on the north side, a substation has been located on North Avenue, with two synchronous converters, three transformers and two regulators, receiving its power over a three-phase transmission line from station No. 5 at Washington and Market Streets; the latter contains a 250-kw synchronous converter taking direct current from the 250-volt outside busbars of the continuous current system and delivering alternating current at 160 volts, and three transformers for raising the voltage up to 4500.—*West. Elec.*, Nov. 18.

REFERENCES.

Coblentz.—An illustrated French abstract of the German description noticed in the Digest Oct. 7. The monocyclic system is used in this plant.—*L'Eclairage Elec.*, Nov. 4.

Central Station Statistics for Germany.—A long French abstract of the German article noticed in the Digest Aug. 5.—*L'Elec.*, Nov. 4.

Small Isolated Plants.—Dary.—An article pointing out the advantages of such a plant containing an engine, a dynamo and an accumulator battery, for farms and country residences.—*L'Elec.*, Nov. 11.

Wires, Wiring and Conduits

REFERENCE.

Brusseis.—Pierard.—A short description of the laying of the telephone lines of Brussels underground.—*L'Elec.*, Nov. 11.

Electro-Physics and Magnetism.

Propagation of Electrical Energy.—An editorial note referring to the experiment described by Osmond in a communication to the Elec. World and Engineer, Sept. 30. It is pointed out that the negative result of the experiment was to be expected, as it is based upon a misunderstanding of Poynting's theory. According to Poynting, in any point of the space, there is a propagation of energy in a direction perpendicular to the plane through the magnetic and electric lines of force at that point, the value of the energy propagate per second through the unit of surface being proportional to the product of electric force by magnetic force, and by the sine of the angle between both forces. For instance, if a straight wire, supplied with an electric current, is considered, the electric lines of force are parallel to the axis of the wire, the magnetic lines of force are circles around the axis in planes perpendicular to the axis; so that at any point of the surface of the wire the tangent-plane contains the electric and magnetic lines of force through that point, and the energy wanders perpendicularly to the tangent-plane in the direction of the radius. In a similar way the propagation of energy may be considered, connected with the discharge of a condenser through a wire. If, now, this condenser is inclined in an earthed conducting shell, the functions of the potential in the space will be altered in such a way that the metal shell is an equipotential surface; until this has taken place, there will be a movement of energy in the metal shell, the quantity of electricity, however, will be small on account of the small capacity of the shell. When the potential along the surface of the metal shell becomes equal, the intensity of the electric force inside of the shell will be zero and there will be no propagation of energy inside of the shell in any direction. (In the main points this explanation agrees with the editorial of Elec. World and Engineer of Sept. 30.)—*Zeit. fuer Elek.*, Oct. 29.

Current Wave of Inductive Coils.—Russell.—An illustrated mathematical article in which the current produced in an inductive coil is calculated for a parabolic wave of e. m. f. A comparison of the results with those obtained in the usual theory for a sine wave of e. m. f. gives the following results: If the sine wave and the parabolic wave of e. m. f. give the same effective volts, then the parabolic wave is more flattened, the maxixum ordinate of the sine wave being about 3 per cent. higher than the maximum ordinate of the parabola. The ratio of the area of the parabola to the area of the sine curve is 1.014, which is also the ratio of the maximum value of the choking coil currents. If both waves are applied to a non-inductive resistance, the effective currents are equal; if they are applied to an induction coil, the current produced by the sine e. m. f. is greater; if they are applied to a condenser, the current produced by the parabolic e. m. f. is greater. For an inductive coil the power factor is always greater for the sine e. m. f., and the impedance and reactance are both greater for the parabolic e. m. f. The impedance for the parabolic wave is not of the form $\sqrt{r^2 + q^2}$ where q is some function of the frequency. In this case also the angle whose cosine equals the power factor is not in general the angle of time lag of the current curve behind the e. m. f. curve. (Concerning the last point, see also the abstract on the theory of the power factor in the Digest below.)—Lond. *Elec. Rev.*, Nov. 10.

Theory of the Power Factor.—Russell.—In the conclusion of his illustrated article (Digest, Nov. 25) he gives a numerical example, the current being a sine wave, while the e. m. f. was either a rectangle, a parabola, a sine curve, a triangle, an inverted parabola or an inverted cubic. The results of his general theory show among other things that with similar curves the power factor is unity and that the more unlike the curves are to one another, the smaller will be the power factor. Also that it is important to distinguish between the angle of phase difference (the cosine of which is the power factor)

and the angle of time lag or lead, the latter angle being defined as the time interval between the two instants when both curves pass through their zero values in the positive direction. If the e. m. f. wave is flat and the current wave peaky, or vice versa, then the power factor may be small, even if there be no time lag between them. If either the current or the e. m. f. wave is a sine curve, and the other is a symmetrical curve, then the power factor is the product of the cosine of the angle of time lag and the power factor when there is no time lag.—Lond. *Elec.*, Nov. 10.

Rotation of a Dielectric Disc in an Alternating Field.—ARNO.—A short illustrated description of the following experiment: A fixed ring-shaped metallic disc 4.7 inch in diameter, was divided into three sectors, each of nearly 120°, and separated from each other by an insulating material 0.43 inch thick; the metallic sectors were connected to a source of three-phase alternating current with 3000 volts effective between each two sectors. Above this disc and parallel to it at a distance of 0.35 inch, there was a circular dielectric disc, movable around a vertical axle, and consisting of paraffined paper 0.04 inch thick and 3.2 in diameter. The disc then rotated, the number of revolutions being so high that it could not be estimated. If the connections to two of the sectors were reversed, the rotation was reversed.—*L'Elettricista*, Oct. 1; translated into German with better illustrations in *Elek. Neu. Anz.*, Nov. 1.

DELL.—A description of a somewhat similar experiment. The upper disc 2¼ inch in diameter is made of mica and placed ¼ inch over a disc of cardboard 3¼ inch diameter. At opposite ends of a diameter of the cardboard two pieces of tinfoil are glued, one extending around the edge to within ¾ inch of the other, one piece being smaller than the other. If the two tinfoils are connected to springs which are touched by the pendulum which is swinging between the poles of the Leyden jars attached to an influence machine (see Digest Nov. 18) the mica disc will rotate in a constant direction. —*Elec. Rev.*, Nov. 15.

REFERENCES.

Divided Alternating Current Circuits.—FELDMANN and HERZOG.—A paper read before the Union of German Electrical Engineers, describing a simple and practical method of calculating the circuits in a divided alternating current network. The physical meaning of Kirchoff's laws appears clearly from a series of diagrams. A numerical example is given, in which the consumers are represented by given currents, not by given resistances, from which it appears that the method is only approximate for practical use.—*Elek. Zeit.*, Nov. 9.

Disintegration of Wires at High Temperatures.—STEWARD.—An account of experiments showing that oxygen is required for the disintegration of platinum or palladium wires; it is, however, not an ordinary process of combustion.—*Phil. Mag.*, November; abstracted in Lond. *Elec.*, Nov. 10.

New Radioactive Substance.—DEBIERNE.—A longer French abstract of the article noticed in the Digest Nov. 25.—*L'Eclairage Elec.*, Nov. 4; *L'Ind. Elec.*, Nov. 10.

Becquerel Rays and Radioactive Substances.—ELSTER and GEITEL. —A French abstract of the German paper noticed in the Digest Oct. 21.—*L'Eclairage Elec.*, Nov. 4.

Canal Rays.—EWERS.—A longer illustrated abstract of the article noticed in the Digest Nov. 4.—*Elek. Zeit.*, Nov. 9.

Lead Peroxide as Coherer Substance.—SUNDORPH.—An illustrated abstract of the article noticed in the Digest Oct. 21.—*Elek. Zeit.*, Nov. 9.

Energy in a Spark Gap.—RIECKE.—A French abstract of the German article noticed in the Digest Sept. 16.—*L'Eclairage Elec.*

Atomic Magnetism.—MEYER.—An abstract of the article noticed in the Digest Oct. 28.—*Elek. Zeit.*, Nov. 9.

ELECTRO-CHEMISTRY AND BATTERIES.

Sterilization of Water by Ozone.—WEYL.—An article in which he shows that ozone arrests bacterial development and sterilizes solutions rich in bacterial life, that a grain of ozone is capable of sterilizing a gallon of water containing 1250 bacteria per c.c., and that in his experiments by far the greater portion of the ozone is not consumed in its passage through the water to be sterilized. He erected a plant capable of treating 25,000 gallons of water per day with ozone in Charlottenburg, the main feature of which is a tower through which the water flows through a layer of coarse stones, meeting the ozonized air on its way downwards. He claims that such a process is cheaper and more certain than sand filtration.—*Centralbl. fuer Bakt.*, vol. 26, p. 15; abstracted by Weston in *Eng. News*, Nov. 23.

WESTON.—Some criticism of the foregoing article, which is claimed to be based on too little evidence. He thinks that the use of ozone and iron as a coagulant for river waters, in connection with the American system of filtration, is perhaps worth considering experimentally.—*Eng. News*, Nov. 23.

Ozonized Water.—ANDREOLI.—An account of a long series of researches of different investigators who tried to dissolve ozone in water and keep it in solution; but all efforts to get a stable solution have failed. Water seems to retain some ozone for a while, but in the course of days no trace of it is left.—*L'Elec.*, Nov. 4.

Purification of Sugar by Ozone.—A report of the results obtained in Noyon with the commercial use of the Verley process, described at some length in the Digest Aug. 19. Although this process does not appear to have reached the limits of its perfection yet, it seems to enable the process of sugar manufacturing to be shortened considerably.—*L'Ind. Electrochimique*, September.

Ozone.—MINET.—A long article describing the Houzean, Bonetti, Andreoli and Otto processes of producing ozone, and its applications for bleaching wax, starch, hemp and flax, for decoloring sugar liquors, syrups and drying oil, for the preparation of oxygenized water, for disinfecting purposes, for the treatment of wood, tobacco and coffee, for amelioration of alcoholic liquids, and for medical purposes.—*L'Electrochimie*, No. 9, p. 129; a long abstract in *L'Ind. Electrochimique*, September.

Electrolytic Treatment of Complex Sulphide Ores.—COWPER-COLES.—The first part of a long abstract of a paper read before the English Society of Engineers. He first gave some particulars of the present concentration system adopted at Broken Hill, where an argentiferous lead concentrate is first produced, sufficiently low in zinc to make it available for the ordinary lead furnace. He pointed out that the present method of zinc distillation is a costly and crude process, the cost of smelting involved in the production of a single ton of zinc, including coal, labor, pottery and stores being generally not less than $20, and about 16 per cent. of the metal contained in the ore being unextracted. He then gave short descriptions of the electrolytic zinc processes of Watt, Diffenbach, Ashcroft, Siemens & Halske, Hoepfner, Mohr, Swinburne, Ganelin and Lorenz.—Lond. *Elec.*, Nov. 10; a brief abstract of the whole paper in Lond. *Elec. Eng.*, Nov. 10.

Reducing Action of Electrolytically Deposited Metals.—BINZ and HAGENBACH.—A paper describing a long series of experiments made to investigate the action of reducing agents on the reducible materials in water. This action is generally supposed to be due to the hydrogen which is liberated, but their experiments seem to show that the metal which would liberate hydrogen reduces the materials directly, and this they show by using coloring matter dissolved in water. The paper is chiefly of a chemical nature. Incidentally they also found that apparently trifling things are of great importance in electrolytic reductions, as entirely different results are sometimes obtained in two parallel experiments made under apparently the same conditions. One of the chief reasons for these differences was found to be the greater or less stirring, as this has a very important influence on the speed of the reaction.—*Zeit. fuer Elektrochemie*, Nov. 2.

Majert Accumulator.—WILKE.—A long illustrated description of this accumulator, which is made by the Oberspree Co. The negative plate, which is of the Faure type, is described and illustrated. The main feature is, however, the construction and manufacture of the positive plate, which is of the Planté type. To obtain a relatively large surface, the plate is grooved with very thin and very deep grooves. For a discharge in one to three hours, the depth of a groove is 0.2 inch, the breadth 0.024 inch, and the breadth of a ridge 0.016 inch, so that there are 25 ridges per inch; the thickness of the core plate is 0.04 inch, hence that of the whole plate 0.44 inch; the weight per square inch (probably of surface) is 1.76 oz. The plates are made with a special shaping machine with a movable cutter, which is described in detail and illustrated; a cutter cuts a slanting shaving from the surface and bends it up perpendicularly, leaving one edge of it rooted to the plate. The positive and the negative plates are formed separately with dummy electrodes in order to remove all traces of chlorine from the negative plates and preventing it from getting into the positive plates. Both plates are formed in an electrolyte like that used in the accumulator. The accumulator is used in power houses and on accumulator cars. 290 cars of the Berlin tramways using 58,000 cells. During one year only 0.1 per cent. of the plates used had to be replaced. The weight of a cell of the smallest type is 21 lbs.; it gives 15 amp.-hours if discharged in ¼-hour with 60 amp., or 21 amp.-hours if discharged in 1 hour with 21 amp.; the safe limit of the charging current is 84 amp. at constant

e. m. f. of 2.55 volts and 24 amp. for constant current. The weight of a cell of the largest type is 119 lbs.; it gives 87 amp.-hours if discharged in ¼-hour at 344 amp. and 120 amp-hours if discharged in 1 hour at 120 amp.; the safe limit of the charging current is 480 amp. at a constant e. m. f. of 2.55 volts and 140 amp. for constant current. —*Elek. Zeit.*, Nov. 9.

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Electro-Zincing.—An illustrated description of a plant using the improved Cowper-Coles electrogalvanizing process of coating boiler tubes and torpedo-boat destroyers with zinc. Zinc dust is added for regenerating the spent electrolyte; the process of circulating the electrolyte between the plating tank and the regenerator are described in detail.—*Ind. and Iron*, Nov. 10.

Electrometallurgy of Copper.—Watanabe.—A note on the electrical extraction and refining of copper, giving full details concerning the European and American practice.—*Elec. Friend* (Japan), July 15 and Aug. 15.

Theory of Ions.—Maillard.—An account of a series of researches in which the electrochemical theory of free ions was applied to problems in biological chemistry.—*Rev. Gen. des Sc.*, Oct. 30.

Conductivity of Solutions.—Dennhardt.—An account of measurements of the conductivity of solutions of salts, showing that there is no close relation between viscosity and conductivity in concentrated solutions. He also measured the conductivity of fatty acids and their alkaline salts dissolved in water or alcohol at different temperatures.—*Zeit. fuer Elektrochemie*, Nov. 2.

Electrolysis in Quantitative Chemical Analysis.—Brief descriptions of the electrolytic methods of Paweck, Campbell and Champion, and Avery and Dales, to determine zinc, tin and iron.—*L'Ind. Electrochimique*, September.

Stand for Electrolytic Laboratory work.—Peters.—An illustrated description.—*Zeit. fuer Elektrochemie*, Nov. 9.

Storage Batteries.—Roberts.—An article of a general nature, discussing the mechanical and electrochemical features of storage batteries.—From *Horseless Age*, in *Sc. Amer. Sup.*, Nov. 25.

Statistics of the Electrochemical Industry.—Borchers.—A long French abstract of the German Electrochemical Society paper, noticed in the Digest Aug. 26.—*Cosmos*, Nov. 4.

Units, Measurements and Instruments.

Names for Physical Quantities.—Juppont.—A communication referring to the article of Hospitalier (Digest Nov. 25). He gives a general summary of proposals which he intends to make at the Congress of 1900. In physical equations, equivalence, equilibrium and equality of vectors should be indicated by special signs. A vigorous system should be used in coining names for physical products and quotients such as are used in chemistry for distinguishing acids. He accepts the proposal of Hospitalier to give to a quotient the name of the dividend as a noun, qualified by the name of the divisor as an adjective, and proposes to coin the names of products in the same way, the adjective ending with *ique* in French (the English equivalent would probably be *ic*) for quotients, and with *aire* in French (the English equivalent would probably be *ar*) for products, so that *lineic* mass means the quotient of a mass by a length, *linear* mass the product of a mass and a length. For the units of the c. g. s. system abbreviations of the quantities should be used, such as *erg* for energy, *wer* for power, *vit* for velocity (from the French vitesse); the reciprocal of velocity would be *tiv*. The names of savants should be used for the practical units. Products with the first, second, etc., power of 10, should be named *deca, hecto, kilo, quarto, quinto, sixto, septo*; products with the reciprocals of the first, second, etc., power of 10, by *deci, centi, milli, quarti, quinti, sixti, septi*, so that *sixto* is equal to *mega*, sixti to *micro* and a *septower* is the practical unit of power. Terms such as conductivity, resistivity, etc., should be used for the physical quality, independently of the numerical dimensions, as distinguished from conductance, resistance, etc., a rule which should be followed throughout (and has already come into quite general use).—*L'Ind. Elec.*, Nov. 10.

Names for Physical Units.—J. B.—An article referring to the proposal of E. H., noticed in the Digest Nov. 25. He thinks that this proposal should be accepted only if a similar rule can be found for naming quantities defined as the product of two other quantities. Instead of the adjective "ergic" he proposes either "energetic" or "ergetic."—*L'Eclairage Elec.*, Nov. 4.

Pidgeon Influence Machine.—An illustrated description of this machine which is now to be used by the English Army Medical Corps in the Transvaal campaign as a generator for Röntgen rays. The essential features are, improved insulation of all parts of the machine, but more especially the carriers, and the combination in one machine of the rotating support and of the fixed support for the inducing charge.—Lond. *Elec. Rev.*, Nov. 10.

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Wehnelt Interrupter.—Ruhmer.—An illustrated account of experiments made to investigate the dependency of the number of interruptions upon the self-induction. The results are given in tables and in a diagram and are in good agreement with the theory of Simon (Digest July 15, Oct. 14).—*Elek. Zeit.*, Nov. 9.

Measuring Dielectric Constants.—Coolidge.—A longer, illustrated abstract of the article noticed in the Digest Nov. 4.—*Elek. Zeit.*, Nov. 9.

Meters.—Armagnat.—The first part of an article giving brief, well illustrated descriptions of new types of meters, taken from patent specifications.—*L'Eclairage Elec.*, Nov. 4.

Long Scale Ampere and Voltmeters.—Davies.—An illustration, with a short description, of the instrument noticed in the Digest March 25 and Sept. 9.—*Sc. Amer.*, Nov. 25.

Telegraphy, Telephony and Signals.

High-Speed Telegraphy.—Delany.—A brief communication concerning a recent criticism in that journal unfavorable to machine telegraphy. He assumes a system for transmitting a thousand words a minute from New York to Chicago for both the machine and the Morse system, and shows that the latter would require two-fifths more operators and sixteen more wires, showing the enormous economy of the automatic system. In reference to the Pollak-Virag system recently described in the Elec. World and Eng., he states that he considers it a long step backwards; it has been shown in this country that automatic transmission with perfect recording is practicable at a speed of three times greater than that claimed for this method, and this is accomplished without the use of a photographic "or other hampering device;" he claims that there is no more justification for the use of the camera in telegraphy than for photographing the letters of a typewriting machine as they appear in view under the pressure of the keys, instead of allowing them to strike the ink band and print direct.—*Elec. Rev.*, Nov. 15.

Telegraphy to Trains in Motion.—C. M. J.—An illustrated communication describing an experiment which may be modified to answer this purpose. In one room he had a phonopore transmitter, one of the secondary terminals of which was connected to earth and the other to an insulated wire reaching into an adjoining room; the other end of this wire was left free or insulated. The receiving circuit consisted of a flat coil of wire, on a board about 4 feet in length, one end being free, and the other end connected to the earth through a Collier-Marr receiver. By placing the flat coil over the wire connected with the transmitter at a distance of about 12 inches, signals could be distinctly read in the telephone.—Lond. *Elec. Rev.*, Nov. 10.

REFERENCES.

Relay for Wireless Telegraphy.—A well illustrated description of the repeater, devised by Guarini-Foresio, noticed in the Digest Oct. 21.—Lond. *Elec. Rev.*, Nov. 10; a shorter, illustrated description in N. Y. *Elec. Rev.*, Nov. 15.

Miscellaneous.

Danger from Alternating Currents.—Nakamara.—He believes that death from electric shock depends greatly on the wave form and the frequency of the current, this being shown by experiments made by many authorities on this subject. It may be fairly assumed that the current which causes actual death is about 0.01 ampere and the insulation resistance of the circuit should therefore be so high that the current through the human body would not reach this limit. The resistance of the human body differs greatly with different individuals, in some it is below 1000 ohms and in some over 6000. Assuming 1000 ohms to be a fair value and let E be the effective voltage, R the insulation resistance of the wire and r the resistance of the human body, then the following relation exists:

$$E = (R + r) \times 0.01 \quad \text{or} \quad R = 100E - 1000.$$

For the following values of E, 100, 1000, 2500 and 10,000, the values of R will be 900, 99,000, 249,000 and 999,000 ohms respectively. These are the minimum limts of the insulation resistance of the circuit, so that the current through the human body should not exceed this limit. In alternating current circuits, however, which contain capacity and inductance, resistance cannot be made to avoid the danger. If, for instance, f is the frequency, C the capacity of a con-

denser and E the voltage, then the condenser current will be $I = 2\pi f C E$ on open circuit, and this is as dangerous as when the circuit is closed; a protective inductive resistance is often inserted in parallel, which reduces the danger to some degree. It is sometimes thought that the low tension circuit of a transformer is not dangerous, but the transformer should be considered as a condenser and should be understood to be dangerous if its capacity is quite large. If e is the impressed e. m. f. of the condenser, R the ohmic resistance of the circuit, C the capacity in microfarads, and f the frequency, then the condenser current will be

$$I = \frac{e}{R^2 + \left(\frac{1}{2\pi fC}\right)^2}$$

If now a person touches the wire connected to the transformer whose capacity is 0.3 microfarad when the frequency is 150 and the terminal voltage 2400, the other terminal of the condenser being grounded, then e is 2400 volts and the current from the above formula will be 0.6 amperes; this shows the danger due to the capacity of the circuit in which there is an alternating current. The article is to be continued.—*Elec. Friend* (Japan), Oct. 15.

Physiological Effects of the Current.—PREVOST and BATTELLI.—A paper stating that the fatal effects of the electric discharge of a battery of condensers are proportional, not to the quantity of electricity discharged, but to its energy, and that the energy required for killing a given animal increases in proportion to the latter's weight. Respiration is arrested by about 400 joules in a one-pound guinea pig, whereas it requires only 250 joules to produce the same effect in one weighing 10 ounces (this can refer only to a sudden discharge, for if the same amount of energy in joules be passed through the animal slowly, the effect would evidently be quite different; it is a question of power and not of work). Young animals are more sensitive to electric shock than adults. Five stages of effects produced by the shock are distinguished: muscular contraction, clonic convulsions, tonic convulsion with momentary stoppage of respiration, general inhibition of respiration and of the nervous system, but without convulsion, and lastly, complete stoppage of the heart's action.—*Comptes Rendus,* Oct. 23; *L'Ind. Elec.,* Nov. 10; *Cosmos,* Nov. 11; abstracted in Lond. *Elec.,* Nov. 10.

REFERENCES.

Lightning.—KANDA.—A full chronological table of thunder storms in Japan, showing the necessity of lightning conductors.—*Elec. Friend,* (Japan), July 15.

The issues of July 15 and Aug. 15 contain an article by Torii on lightning conductors. It is a translation of the recommendations of Lodge concerning the construction of lightning rods.

Development of Civil Engineering.—Fox.—A long abstract of his presidential address delivered to the English Institution of Civil Engineers, especially of those portions which relate to electrical engineering. He gives an outline of the achievements of this century and speculations on the further development. The question whether there may be a finality in electrical engineering, is discussed in a separate editorial and it is pointed out that a finality is not in sight as long as electrical practice is able to meet new demands.—Lond. *Elec.,* Nov. 10.

New Books.

MAGNETISM AND ELECTRICITY. An Elementary Treatise for Junior Students Descriptive and Experimental. By J. Paley Yorke. London: Edward Arnold. 264 pages, 145 illustrations. Price, 3s. 6d.

This book, according to its preface, has been written primarily for the student, and incidentally covers the syllabuses of the matriculation examinations of the University of London and the local examinations of the Oxford and Cambridge Universities. The preparation of his readers for a definite set of examinations evidently limits the author's freedom of choice of method of treatment. While the statements made in the book are in the main correct and clearly expressed, there is nothing novel as to the topics treated. It seems as though descriptions of mechanical contrivances for proving the correctness of the tangent law occupies space which could better be devoted to an elucidation of the trigonometrical functions. Again, descriptions of the methods of magnetizing by single touch, double touch and divided touch could better give way to some account of hysteresis, which is not mentioned.

BOOK RECEIVED.

THE USE OF THE SLIDE RULE. By F. A. Halsey. New York: D. Van Nostrand Company. 84 pages, 18 illustrations, 6 plates. Price, 50 cents.

Electric Train Lighting from the Axle.

A field of electric lighting that has long attracted the energies and attention of the inventor and engineer, but has until recently remained far behind in proper development, is the illumination of cars of all kinds of steam railroads. While there are many difficulties to overcome in such work, there are no inherent impossibilities blocking the way to success, and it has therefore been surprising that approximate perfection and practical results were so slow to appear. Perhaps in some respects it was another of those cases where, aside from the application of distinctive ingenuity, the various parts of such a system of lighting were themselves imperfect and underdeveloped; until of a sudden, with the emergence of the correct ideas for doing the thing, the appliances are also found suitable which not long before had fallen short of utility. It cannot be gainsaid that the latter day perfection of the accumulator has breathed life and vigor into a host of electrical industries languishing previously for lack of it; and that while on one side electrical development hastens because of better methods of transmission, it is equally true on the other hand that it is being tremendously stimulated by better apparatus for storage.

Train lighting belongs peculiarly in the storage battery group of arts and must so remain probably even when the roads are operated by electricity throughout. For the present régime of steam under which no fewer than 35,000 cars have to be lighted, the system of the Electric Axle Light & Power Company, of New York City, com-

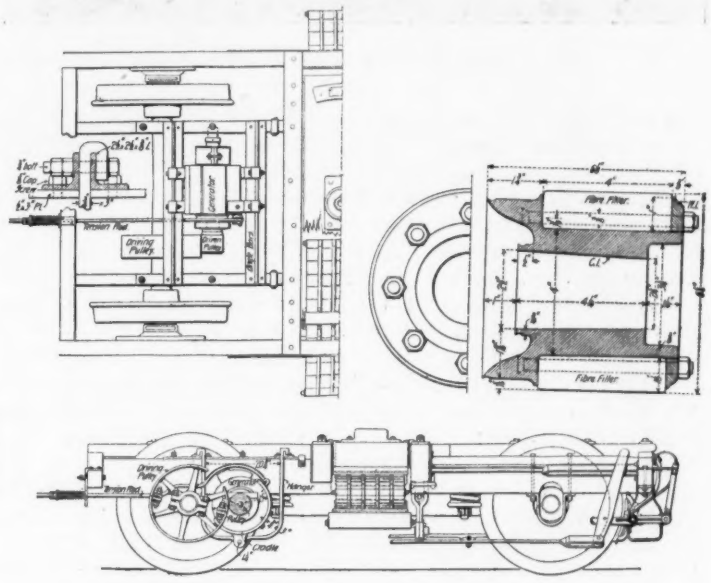


FIG. I.—ARRANGEMENT OF GENERATOR, AXLE, PULLEYS, ETC.

mends itself by its ingenuity and simplicity. It is based primarily upon the patents of Mr. Morris Moskowitz, and has been worked out with great care and thoroughness during the past five years, chiefly on western roads, one of which, the Atchison, Topeka & Santa Fé, has over 100 of its cars thus illuminated. Within the past two months the system has been applied on its cars by the progressive new management of the Delaware & Lackawanna, and it is not overstating the case to say that at this moment electric train lighting has been opened up as one of the best fields now offering for the application of electricity on a very large scale. The demand for apparatus thus created, while gratifying to electrical people, is perhaps not to be compared in any degree with the increase of comfort and pleasure afforded the traveling public of which we are all members. The reality of this comfort is curiously and emphatically shown by the fact that on trains having some of the cars thus lit, all the passengers pile into them, leaving the others with the old style of oil or gas lamps vacant.

As the name of the company furnishing this system suggests, the current is obtained from the car axle, being thus in sharp contrast with such methods as have been tried depending upon a complete separate steam plant installed usually in the baggage car. In this

case, as shown by the diagrams and one of the perspective cuts, a small dynamo is carried on one of the car trucks and is driven by friction pulley from the car axle. It will be observed that the axle does not serve as a bearing in any sense, and is thus relieved of strain or risk that might come from such use. If the little generator should chance to be short-circuited, it is not destroyed, but all that succumbs or needs renewal is the paper form or jacket on the small pulley. Mr. Moskowitz's experience with belts and many other drives more or less positive, has demonstrated the entire preferability of this method. There are, moreover, but two bearings to be oiled, and a much more regular generation of current is obtained.

FIG. 2.—PASSENGER CAR WITH ELECTRIC LIGHTS.

The method of oiling for the generator consists of exceptionally deep oil wells in connection with oil rings traveling over the shaft. One oiling will carry a car from 500 to 700 miles.

The dynamo does its work with the car running at the speed of 15 miles an hour and upward. The machine, being a self-excited generator, builds up from zero to 15 miles an hour, at which speed it will develop 40 volts, but beyond the speed here indicated, no variation makes any appreciable change in the voltage. If a train were always running, the current thus generated could, of course, go direct to any lamp switched in, or if it were like a trolley car it might depend on the line contact. But there are very few trains, even fast expresses, that make no stops, and the next point therefore is to provide a liberal reserve. In the system of the Electric Axle Light & Power Company, this is furnished by two groups of light storage batteries which are strapped under the car body and which have a capacity of 20 hours. These Chloride cells are specially built for their work by the Electric Storage Battery Company, and have proved most satisfactory. They supply current to the lamps at 30 volts. In an ordinary passenger coach there are no fewer than 17 of these lamps, each with its porcelain reflector, placed not in one or two big clusters as with oil or gas, in the aisle, but distributed along the inner edge of the eaves, so that every passenger has an equal share of illumination, without shadows. The 30-volt lamps have necessarily very short filaments, but are for that very reason little affected by the vibration of the car, and enjoy a long life. As there is little wiring, the low voltage is made the more feasible and appropriate. Besides the liberal use of the lamps in the car, the system permits what no other illuminant does, the use of a lamp in the toilet room, while another is put on the car platform where its convenience is at once appreciated.

At the end of each car, as seen in one of the illustrations herewith, the controlling and switching mechanism is concentrated in a handsome little board, cased within a box with partial glass front. The box is also shown complete. Within the box are the automatic switches which govern the connection of the generator and the batteries, and the batteries with the lights. As the car starts, and the voltage of the generator current rises, one of the switches throws the machine in multiple with the batteries and the lamps. The dynamo then supplies current at a pressure of about 40 volts, so as to feed the batteries, but the lamp voltage does not rise above 30 volts, as a small resistance is cut into circuit at the same time; so that whether energized by the dynamo or by the batteries or both, the lamps are kept steadily at their normal pressure and candlepower. Should the dynamo by the backing of the train, or the change of direction of travel of the car, be reversed, an automatic pole-changing switch immediately reverses the dynamo connections, with reference to the battery, and thus obviates any short circuit. The reliability of the switching apparatus, concentrated at the box and all of it of easy access, is enhanced by the fact that its ingenious design enables it to break circuit at the times when no current is flowing, so that all arcs within the box are avoided.

Nor is this all. If any car should get disabled from any of the accidents liable to occur on a road, it can be plugged into the circuit of an adjacent car and thus supplied with light. Another feature is that the availability of current permits the use of fan motors, some of which are used with the system already, rendering it easy to shut out the cinders and dust and still be cooled and refreshed by a breeze. A few years ago this desideratum was noted by correspondents of this journal, among them medical practitioners, who said that if they could secure the use of electric fans they could often transport patients otherwise unable to endure the heat and dust of the journey.

Incidentally it should be noted that storage batteries operated under the conditions of this service are ensured unusually long life. The battery cannot be overcharged, as the voltage of the axle dynamo is automatically regulated to prevent this, nor can it be discharged with undue rapidity, as the number of lamps is fixed in advance. It is seldom overdischarged, as before it has had an opportunity to discharge its rated output, it is again being charged. For the same reason it is hardly likely to be left without charge, and neglected, as it is charged every time the car goes out. It follows that the current is drawn from the battery at a very high rate of efficiency, and that all the conditions are quite favorable to its endurance and longevity. At the same time, the battery can be enlarged or increased in capacity, so that a greater output is obtainable. In some cases the company have put, on request, as many as 70 or 80 lights in a special parlor car or dining car.

One of the vital points in train lighting is the cost, closely associated with which is the intense desire of railroad managers not to overtax directly or indirectly the steaming ability of their locomotives. As a matter of fact, the Electric Axle Light & Power Com-

FIG. 3.—TRUCK OF RAILROAD CAR WITH CRADLED GENERATOR.

pany after pursuing this part of the subject to its last refinements, state that they can set no figure of cost. The reason is this: The lamps in any car will take, all burning, less than 2-hp per car. With the modern high-speed locomotive of 1000-hp the total energy required to light the train of several cars is obviously brought down to fractions of one per cent. of the total load, and any usual differences in coal, firing, valve setting, etc., would so conceal and absorb this percentage as to make it extremely difficult of isolation for any figuring on cost. It would therefore seem that the cost comes out somewhere in depreciation, lamp breakage and extra attendance, if any should be necessary. Moreover, there is the great advantage that

even the insignificant effort required from the locomotive is not put upon it at the time when all its energy is needed in starting up its load from a dead rest, but only after it has got well up to speed.

There are other points in favor of electric train lighting not to be overlooked. One of the leading authorities on railroad work, Col. H. G. Prout, remarked a few years ago: "Fires in wrecked trains have originated probably quite as often from kerosene lamps as from the stoves. * * * The ideal light for railroad trains will probably be found in electricity. It is even safer than gas, and is the most adaptable of any known method of lighting." These are features of advantage that need not be insisted upon to-day, as they will at once be conceded.

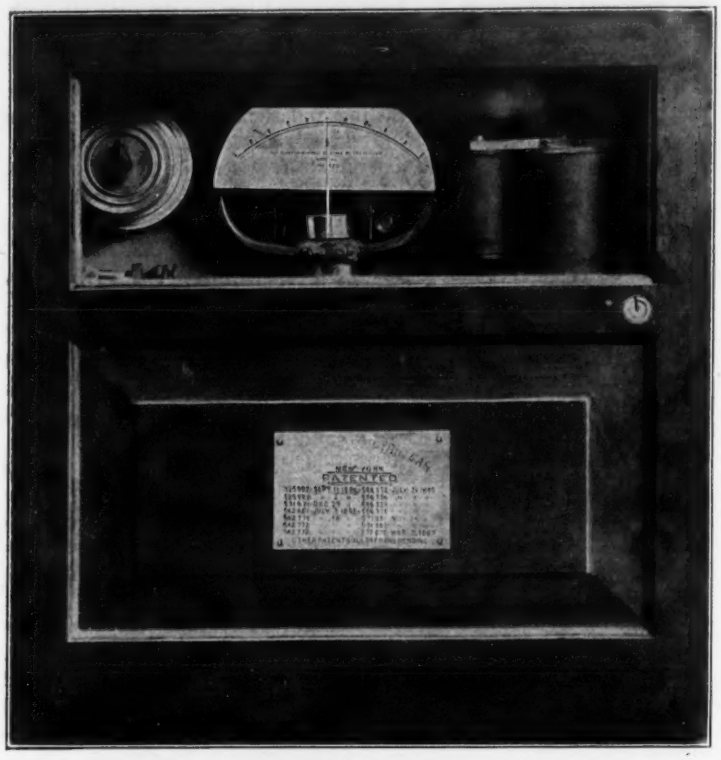


FIG. 4.—SWITCHBOARD BOX IN CAR.

The Electric Axle Light & Power Company, to which work attention has been directed above, was recently incorporated under the laws of New Jersey, with a capital of $25,000,000, after acquiring various properties and patents in its field. In addition to its lighting of passenger cars, it is already applying analogous methods to the refrigeration of the 13,000 cars used especially for the cold transportation of perishable freight. Here again it is said the benefits of electricity are so conspicuous and undeniable as to indicate an impending revolution in the economics of handling meat, fruit, etc., on thousands of cars now devoted to that service.

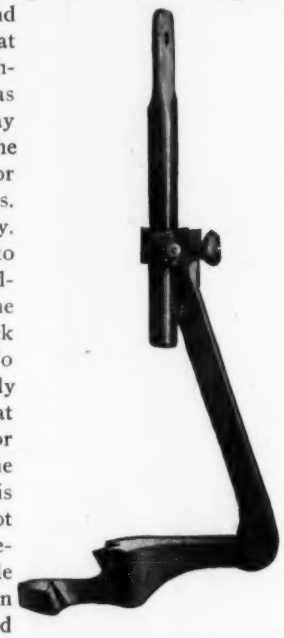
The Fort Wayne Electric Works.

During the four months' existence of the Fort Wayne Electric Works, at Fort Wayne, Ind., the concern's business has rapidly increased, necessitating the addition of several thousand dollars' worth of new machinery. The product of the various departments, including the meter department and the lamp department, have increased fivefold in that time. The several departments are now doing more business than ever in the history of the preceding companies. This activity is largely due to the efforts of Mr. James J. Wood, general superintendent and electrical engineer of the works, whose inventions constitute a large part of the foundation of the concern's business. After the failure of the old Fort Wayne Electric Corporation the plant would have been moved away from Fort Wayne had it not been for Mr. Wood's personal efforts to keep them in that city. The result was the incorporation last May of the present concern, with a capital stock of $500,000, fully paid in. The officers are: Henry C. Paul, president; John W. White and Charles S. Bash, directors; F. S. Hunting, treasurer and sales manager; Delbert O. Davis, assistant treasurer; James J. Wood, chief electrician and mechanical engineer. Mr. Wood is also in full charge of the factory, a position which he has successfully filled for so many years, under the old régimé.

During the four months of the new concern's existence Mr. Wood, it is stated, has brought out several inventions, including a new arc lamp for Chicago City. This lamp is reported to have proved successful, and the works have received several large orders for them. Mr. Wood has patent applications pending on other new devices, nearly all of which have been placed upon the market during the past four months, and which include an automatic motor starter with over and under load releases; new methods of mounting arc cutouts and primary fuse boxes, which not only increase their insulation resistance, but decrease the fire risk and their tendency to short-circuit or burn out, as well as making the devices much simpler to install. These, and many other improvements which have been made in lamp suspension devices, in the transformer department and dynamo departments, have resulted in securing for this company the largest amount of business ever received in the same length of time in the history of the works, the company now having at present unfilled orders amounting to several hundred thousand dollars, or enough work to keep the factory running at full time from now until Jan. 1, 1900. These orders include contracts from Vincennes, Ind., Knoxville, Pa., El Paso, Tex., Chicago, and a large number of smaller plants all over the country. The works are being run at night as well as by day in order to catch up as far as possible with the unfilled orders.

Gravity Lamp Clutch.

The clutch shown in the accompanying illustration is designed for use with the T-H type of arc lamp and is claimed to be the only clutch that can be put in place on the lamp without removing the rod, and which has but one pivotal hinge, thus doing away with the friction incident to the usual type of clutches having two or more joints, or hinge post and springs. The clutch operates entirely by gravity. It is claimed to have no lost motion, to give the surest possible grip, and admit of an extremely sensitive feed. The clutch will not pit the rod and will pick up full arc instantly after feeding. To apply the clutch to a lamp it is merely necessary to tilt it to such an angle that it will pass between the rod and coil or rod and frame and then connect to the rocker. The operation of trimming is reduced to a minimum, and it is not necessary to throw the switch in renewing carbons. The clutch is made for first and second side feedings, in the former case having an extended staff with a set screw in the upper end. The manufacturers are John L. Peterson & Company, Galesburg, Ill.



GRAVITY LAMP CLUTCH.

The "Belden" Arc Lamp.

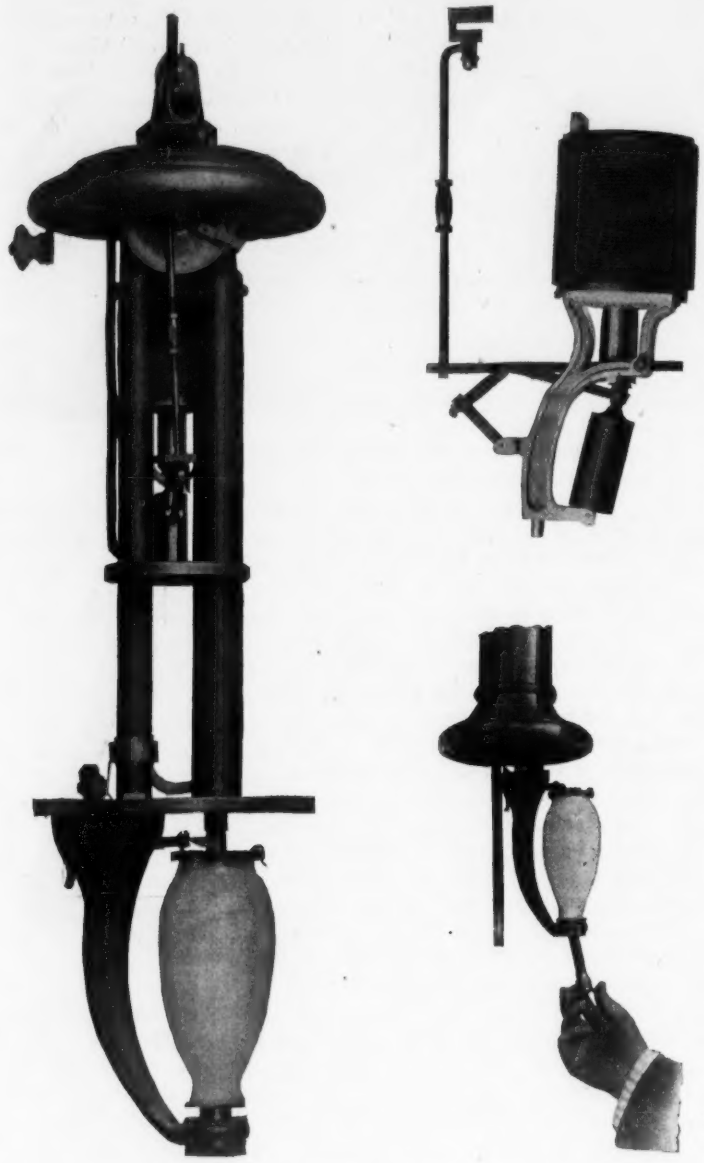
Though in use but a few years the enclosed arc lamp has undergone radical improvements in its mechanism during that period, and the illustrations accompanying this article showing the Belden enclosed arc lamp well confirm this statement. The refinement of design which it embodies is evident from the statement that the removal of one screw permits the entire mechanism to be removed as one piece, so it can be placed on the bench and any repair made without necessity of further dissembling and consequent loss of time in reassembling. There is also an entire absence of springs, sliding contacts and carbon rods; ball bearings are used and knife-blade joints employed throughout.

As will be seen by referring to the illustration, showing the mechanism separate from the lamp, the movement of the core of the solenoid is transmitted to the releasing arm through a toggle-joint arrangement. By this means the varying effect of the solenoid on the core and consequently varying pull, are equalized. That is,

when the core is well up in the solenoid and subject to a less pull per ampere of current in the coil, the toggle mechanism exercises a greater power, and vice versa. This mechanism also gives a greatly increased range of motion on normal current—in fact, the possible separation of the carbons at the arc being three times the normal separation. This feature eliminates the hissing and simmering of the arc which is common in lamps in which a slight wear has made it impossible for the carbons to promptly separate to the normal distance when the current is turned on.

The lamp is of the chain-feed type and its moving parts are always in perfect mechanical balance. The chain is one-half the weight per inch of the carbon, and as the latter burns away, the change of chain from one side to the other exactly balances the weight at all times. Thus the preponderance of weight on the upper carbon is kept constant, thereby ensuring good regulation.

No springs at all are used in the lamp. The magnet core is provided with an adjustable weight, arranged so as to accomplish what usually requires the presence of two or more springs. Another point of advantage is that there is no part of the lamp which must be in alignment with any other part. In the working of the clutch or grip dog which operates in connection with the flange wheel, the clutch releases without striking a trip post; this absence of a trip post of any kind eliminates the change of voltage every time the lamp feeds, which occurs with the usual tripping arrangement.



FIGS. 1, 2 AND 3.—BELDEN ARC LAMP.

The lamp is so insulated that when the current is on there is no uninsulated portion exposed. There are no sliding current contacts, the current being carried to the upper carbon by means of a flexible asbestos-covered cable.

As will be seen from the illustration showing the method of trimming, the great objection that has been made against enclosed arc lamps on the score of difficulty in trimming, is in this case entirely obviated. The burned-out upper carbon can be replaced with a new carbon without removing the inner globe, the lower carbon or opening the case; and the burned-out lower carbon can be replaced with a new carbon without removing the inner globe or any part of the lamp. Should the upper carbon be broken short in the holder, the stub may be removed by pressing a small latch at the back of the inner globe bracket, when it may be drawn down and turned one side, thereby giving free access to the upper carbon holder, as is shown in the illustration.

The frame of the lamp has been designed for the greatest strength and rigidity with the least weight. It consists of two tubes of cold-drawn steel, such as are used in bicycle frames, to which are brazed a lower steel stamping and another one for the mechanism, while at the upper ends are a hollow casting and sheave wheel housing, this construction making a very rigid, though light structure.

The lamp above described and illustrated is made by the Belden-Larwill Electric & Manufacturing Company, Fort Wayne, Ind.

A Marconi Wireless Telegraph Company for America.

Articles of incorporation have been filed with the Secretary of State at Trenton, N. J., for a corporation with an authorized capital of $10,000,000. This company is to be known as the Marconi Wireless Telegraph Company of America. One-half the authorized capital is preferred stock, with 8 per cent. non-cumulative dividend.

Arrangements have already been made for the purchase of the Marconi patents and the acquiring of rights to operate in all the American possessions and in Cuba. The company is empowered to operate over land and sea. The incorporators are Guglielmo Marconi, London; Isaac L. Rice, August Belmont and Clement A. Griscom, New York, and Robert Goodbody, Paterson, N. J.

Mr. Isaac L. Rice, who is to be president of the new company, states that the factories and headquarters will be established in New York. "We shall be in active operation just as soon as it is possible to find suitable quarters and build the machinery. Special attention will be given to the manufacture of wireless instruments with which to equip ships that they may communicate at sea. There will be large orders for establishing communication between points where it is not practicable to maintain cables. We expect to equip the signal and life-saving stations along the coast with the wireless system, that they may warn approaching vessels in time of fog or storm. The uses to which the wireless system may be put are almost unlimited. There is an immense field before us, and the system is as yet in its infancy. We shall have no interest in the contract that was recently made to connect five of the Hawaiian Islands by wireless telegraphy. That was entered into before our company was fully organized. We shall control all other rights in Hawaii, however, as well as in all the American possessions and Cuba."

August Belmont is to be treasurer of the company, and Mr. Rice is now taking active steps to organize his forces for the development of the company. Just how much Mr. Marconi is to get for his system here is not known, but it is authoritatively stated that in England after refusing £10,000 from the government he got £17,000 from the English company and £50,000 in £1 shares which afterwards rose in value to £8.

A special despatch from London of Nov. 25 says: Wireless telegraphy, Marconi's system, has finally been introduced into the navy as a branch study. The old hulk Hector, lying at Portsmouth, has been fitted out as a school of instruction, and signalmen from her will be attached to the battl ship Canopus, which goes to the Mediterranean in December, taking Marconi instruments as part of her regular equipment. She will be the first British ship to do this.

From Washington a special despatch of Nov. 24 says: The War Department is quietly at work on the problem of wireless telegraphy for the signal service. The Signal Corps has been handicapped recently both by lack of funds and officers to experiment on an extensive scale, but Capt. S. Reber, at Governors Island, N. Y., is carrying on a series of experiments between that point and Tompkinsville with a view to adapting the army apparatus for communication between fortified points and in any other locations where the wireless system might prove superior in practice to the older form of telegraphy. The army is not dependent on Marconi for instruments, having developed a system of its own, and the work will be pushed with vigor when Congress furnishes the necessary means.

It may be noted that suit has been brought against Mr. Marconi in the United States Circuit Court by Lyman C. Larned, of Boston, for infringement of the patent granted Oct. 5, 1886, to Prof. A. E. Dolbear, of Tufts College. Betts, Betts, Sheffield & Betts and E. H. Moreau are the attorneys for the respondent, and Henry A. Prince for Mr. Larned. The bill of complaint was filed in the United States Circuit Court, Oct. 5 last. The suit is spoken of with contempt by Mr. Marconi's representatives in the new company.

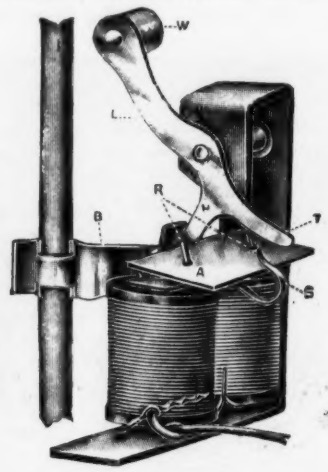
A Simple Halfshade Reflector.

The two illustrations shown below are of a simple form of incandescent lamp half and parabolic reflector being placed upon the market by The J. Jones & Son Company, 64 Cortland Street, New York. The reflector itself and the method of attachment are so clearly shown that little explanation is needed concerning them. An important advantage is the doing away with the use of a shade holder, thus rendering the shade applicable to any lamp with minimum trouble. An extension piece has a hole at the outer end into which the lamp tip is placed and the wire clamp at the upper end of the shade clasps the lamp around the neck with a firm hold. The reflector can be turned to any position around the lamp. It is light, being made of aluminum.

A New Annunciator Drop.

The annunciator drop shown in the accompanying illustration has a mechanism made entirely by stamping and punching, and yet unites the qualities generally considered inseparable from refined processes of workmanship. The armature, *A*, consists of a rectangular stamping of sheet iron containing two punched holes into which enter the prongs, *p*, the shoulders of which serve as pivots. The armature is held away from the magnet cores by the hook-shaped spring, *S*, of sheet brass, and retains the indicator by engaging the heel, *H*, of the lever, *L*. When the armature is drawn down by the magnets, this lever drops, being overweighted at *W*, and is reset as usual by the arm, *B*, on the restoring shaft.

HALFSHADE REFLECTOR.



ANNUNCIATOR DROP.

The advantages of this construction are obvious. The armature being suspended at its centre of gravity, is not likely to be thrown down by any mechanical shock or jar. The spring being of the flat type and having very slight motion, does not require adjustment and is not apt to break or weaken even after long and severe use. Should any armature stick to the magnet when the drop is operated, the projecting toe, *T*, strikes the right hand side when the drop is reset, thus restoring it to its proper position. When any drop is reset, the shafts of all the other drops are slightly disturbed, thereby keeping them free in their bearings. The bell is mounted on the front cover so that by removing the screws fastening the side of the case it may be readily removed for adjustment or repairs. The manufacturers are the Star Electric Company, Binghamton, N. Y.

The Mietz & Weiss Direct-Coupled Generator and Kerosene Engine.

The successful operation of the kerosene engine in isolated electric lighting plants opens a large and particularly useful field of application. The ease of management, economy and safety recommend it as a very desirable motor in places where the steam engine is not always available.

The Mietz & Weiss engine is of the two-cycle compression type, receiving a power impulse every revolution, and provided with a sensitive governor maintaining the steady speed required for belted or directly coupled generators. A small pump operated by the governor and controlled by the same, injects the exact amount of kerosene (ordinary lamp oil) directly into the motor cylinder, where it vaporizes and mixes with air for combustion.

The coupling is shown in one of the accompanying cuts. To a

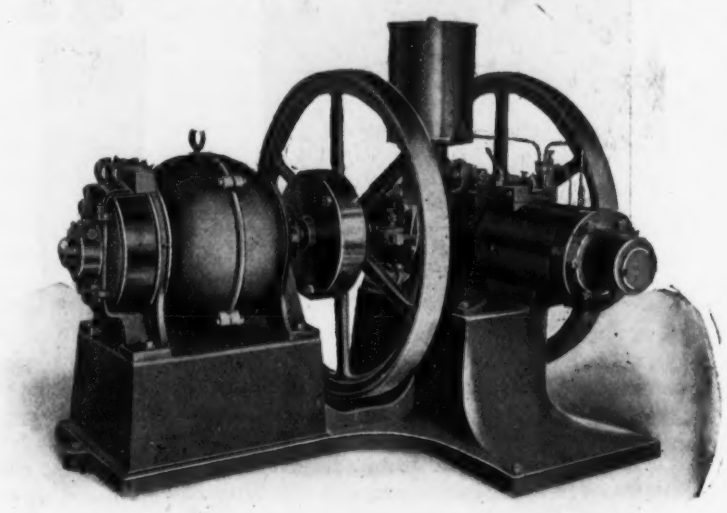


FIG. 1.—GASOLINE ENGINE AND ELECTRIC GENERATOR.

disk keyed to the armature shaft are fixed three studs in the form of an equilateral triangle. Three studs are also fixed to the disk carried by the flywheel of the engine and so positioned as to allow one set of studs to clear the other set when the disks are freely rotated. Rubber rings of sufficient strength to carry more than the machine load actually requires are held on to the studs by the outer shoulder to prevent their slipping off. The stretch of the rings is equal to the load transmitted, hence their elasticity is maintained in the same proportion. A small irregularity in the alignment of the engine and dynamo using this coupling does not affect the operation in the least. The engine as well as the generator is complete in itself, running in their own bearings and avoiding all strain and friction which result from rigid couplings. The

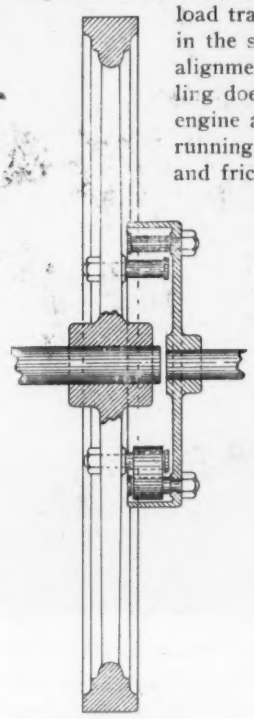


FIG. 2.—COUPLING.

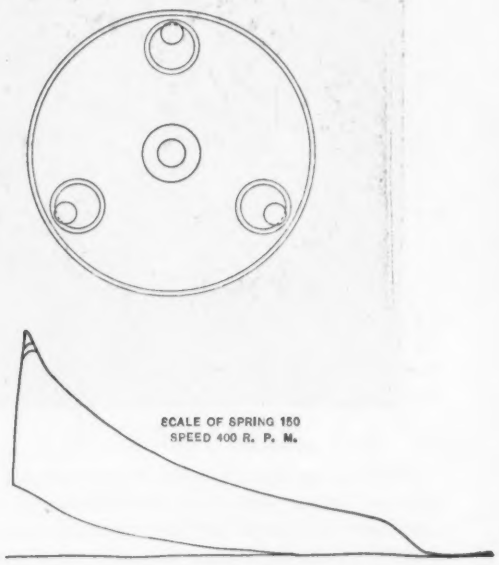


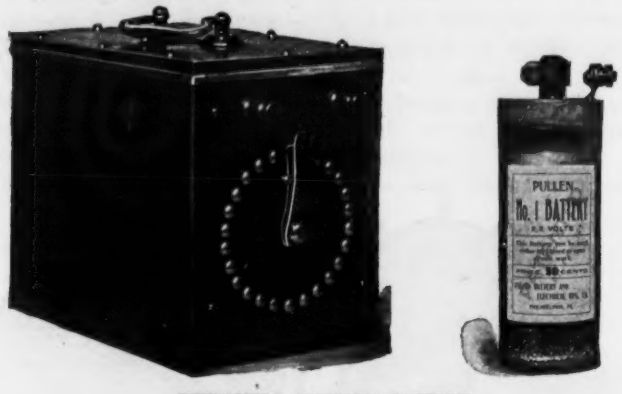
FIG. 3.—INDICATOR DIAGRAM.

flange on both sides and face of the coupling flange prevents oil getting inside, at the same time giving a smooth surface and neat appearance and allowing the generator and engine shaft to play endwise.

The indicator diagram shown herewith is from a 4-hp engine running at 400 revolutions per minute, coupled to a generator giving 40 16-cp lights, the engine consuming 1.32 pounds of kerosene (150°) per horse-power hour.

The Pullen Reversible Primary Battery.

The pullen cell, the outside appearance of which is shown in the accompanying cuts, is a reversible primary battery. Ten per cent. sulphuric acid is used as the electrolyte and carbon as the positive electrode, in the form of a cylindrical rod like ordinary arc light carbons, surrounded by a thick layer of a black mass which is used



REVERSIBLE PRIMARY BATTERY.

as a depolarizer, and which differs from that employed in the usual Leclanche or dry cells. The negative electrode is a zinc cylinder surrounding the carbon electrode. The strong activity of the depolarizer has been shown by the inventor in an interesting experiment. He formed an improvised cell by touching the end of a carbon and zinc rod, each one-half inch in diameter to the opposite sides of a cloth, saturated with dilute sulphuric acid and closed the circuit by an electric bell. The action was too weak to ring the bell; but as soon as he added some of the depolarizer between the carbon rod and the cloth, the bell began to ring at once and did not stop until the sulphuric acid was consumed; the formation of sulphate of zinc could be seen. If then some fresh electrolyte was added, the bell began to ring again.

The e. m. f. of the Pullen cell on open circuit is given at 2.2 volts, and the internal resistance is small. The cell can be used to advantage for electric bells, fans and all such purposes like other primary cells. The main point of interest, however, is that it is said to compete successfully with accumulator batteries in automobile traction. The inventor states that the cell may be discharged to a very great degree without being injured and that it can be recharged again by simply connecting it with the mains of an electric station, in the same way as accumulator batteries. The inventor points out that no lead at all is used in his cell, and that it is therefore possible to construct it exceedingly light, compared with lead accumulators and therefore of great advantage in driving automobiles. The complete weight of a battery of 44 Pullen cells, ready for use on automobiles, is given at 300 lbs. This is said to be sufficient to drive an automobile with two people over 35 miles with one charge, the complete weight of the automobile with the battery, but without passengers, being 1100 pounds. A rough test of one of the very small cells, weighing complete in glass jar 16 oz., showed the voltage on open circuit to be 2.04 and the current on short circuit as much as 15½ amperes, which after about 20 minutes of short circuit fell to 1½ amperes. As to the energy to be obtained from a Pullen battery, it is stated that one-hp hour is available for every 50 pounds of complete battery, if discharged in 6 hours. The Pullen cell is made by the Pullen Battery & Electrical Manufacturing Co., 27 N. Second Street, Philadelphia, Pa., under the patents of Leon W. Pullen.

New Type Sunbeam Lamps.

The new type Sunbeam lamps are made in a number of forms, of which four are illustrated in the accompanying engraving. The lamp with the unanchored filament gives 16-cp on a 52-volt circuit, while the lamp shown with the single anchor is for use in series on electric railway circuits of 500 and 600 volts, its candle-power being also 16. The double-filament lamp is for 220-volt circuits. The small round bulb lamp is for decorative purposes and is made for candle-powers of 2, 4, 6, 8, 10, and 16, and for all voltages from 45 to 130.

The new type of Sunbeam lamp embodies the very latest improvements in lamp manufacture. Every lamp is individually exhausted, both mechanically and chemically, and the vacuum obtained is as nearly perfect as known methods can produce. No electrical discharge occurs between the filament and the bulb, and the latter is made of glass which combines strength, clearness and brilliancy in the highest degree. A special method of basing lamps is used which insures neatness and prevents the possibility of crooked bases so often noticed in the usual incandescent lamp.

Great care is taken in standardization, each lamp being measured for candle-power while revolving, thus insuring accuracy in rating. The various standard types of lamps are made for three economies —3.1 watts, 3.5 watts and 4 watts per candle.

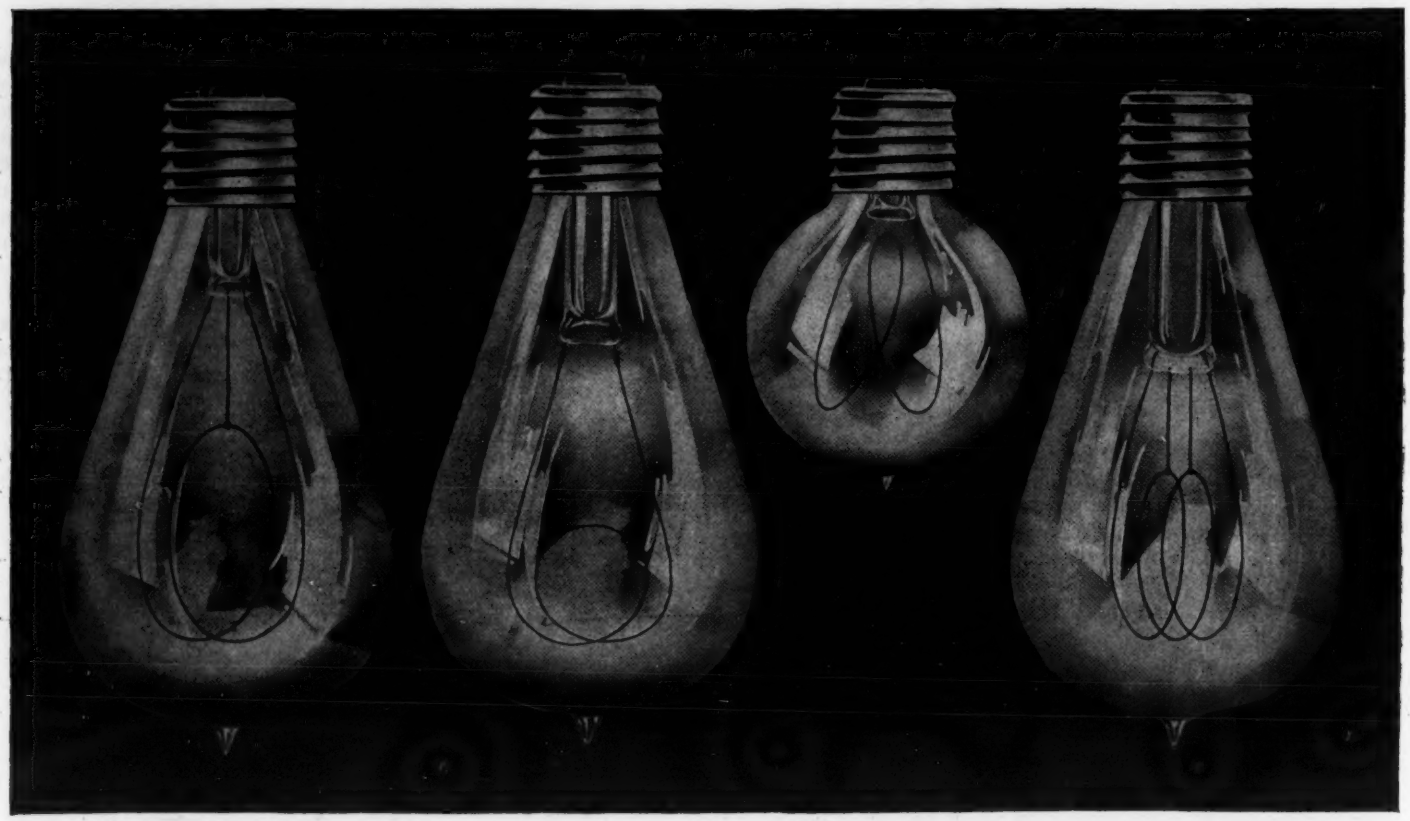


FIG. 1.—ELECTRIC RAILWAY LAMP. FIG. 2.—52-VOLT LAMP. FIG. 3.—DECORATIVE LAMP. FIG. 4.—220-VOLT LAMP.

New Westinghouse Electric Railway Motors.

Four new electric railway motors have recently been added to the Westinghous list of this apparatus, designated as 50-C., 56, 68, 69 and 70. Of these we illustrate No. 56 and No. 69, the field of the former being also shown.

The same general construction is followed in motors No. 69 and No. 68, which vary in capacity from 20 to 40 h. p. They are fitted with removable laminated pole pieces bolted to the yoke, the coils

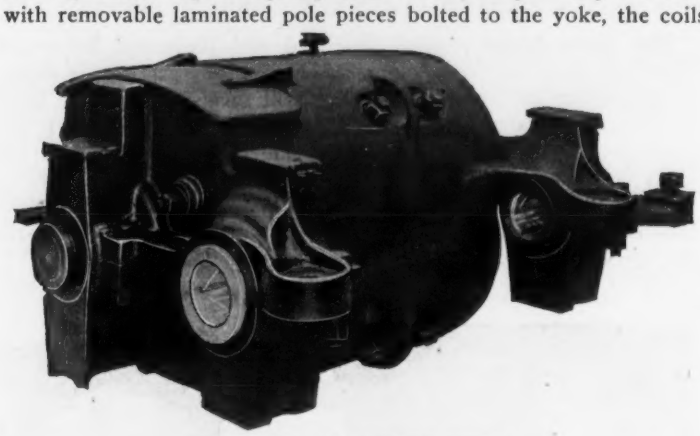


FIG. 1.—NO. 56 RAILWAY MOTOR.

being held in place by pole tips. The bolts which retain the poles do not pass through them, but terminate in a long nut inside the pole piece. The pole face, therefore, presents a smooth, unbroken surface, and the pole is perfectly rigid. The bearings are extra long and designed for either grease lubrication from above or oil lubrication from an oil wick at the side. In this position the oil can be inserted more easily than with a center wick, and the feed being between the gears, the pressure is the least at this point between the shaft and the bearing.

Where rapid inspection of motors is important, the two above-mentioned types are particularly applicable, as they are so designed that by removing the axle caps and the pin from the suspension link the motor can be lowered into a pit. Where this design of motor is used, provision is made in the car barn or shop for a ram, or pit jack, which lifts the motor into place on the cars or lowers the motor into the pit. With this equipment it is the practice to substitute one motor for another under the car, the new motor having been previously inspected and the old motor being laid aside for inspection the next day. Provision is made for hinging the upper field, so that it can be raised and inspection made while the motor is lying on the floor. In this manner a thorough inspection of all parts of the motor can be made with the greatest convenience, and the inspection need not be made at night, or in a hurry, due to the fact that the car must be in service again in the shortest possible time. It has also been demonstrated that the time for changing motors in this system is very much less than

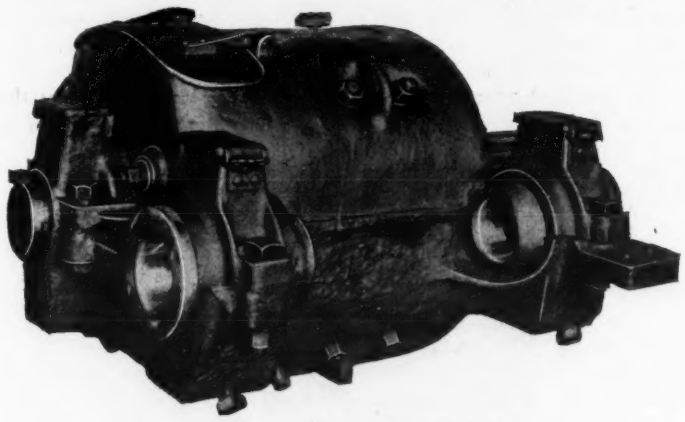


FIG. 2.—NO. 69 RAILWAY MOTOR.

the time necessary for inspection of the motors underneath the car.

Special provision is made for centring the motor on the head of the ram or jacket referred to above. With a motor properly centred in this manner it can be raised to its exact position under the car, and no time is necessary for adjustment. The brush holders have adjustable coil springs, and the armatures have sunken bands and short-necked commutators. Three formed coils are placed in each slot. The motor is arranged for either cradle or nose suspension. While the method of dismounting and inspecting the interior is the quickest possible, it requires, as stated, the use of a pit-jack, so that this motor will probably be most popular on those roads where the car house and repair shop facilities are quite complete. In other words, this motor is particularly for large roads, and is the one adopted by the Third Avenue Railroad Company, New York, and the North Jersey Traction Company.

The No. 56 motor is similar to the No. 68, but is more powerful and intended for the heaviest city, suburban, and interurban work. The pole pieces are removable, like those of the No. 68 and No. 69. The bearings are long and the lubrication is identical with that previously described. The commutator is built up of drawn copper segments, and is very deep, allowing for a great amount of wear. Band wires retain the armature coils, and are sunk in the periphery of the core, thus obviating any danger of cutting them should the bearings be allowed to wear until the armature strikes the pole pieces. The amount of copper in the field winding is very large, and the motor is designed throughout with a wide margin for heavy overloads.

For inspection the motor is run over the pit, the bottom half is unscrewed, which with the gear casing is hinged at the middle. The interior of the motor and the armature can then be inspected without dismounting the frame from the car axle. The lower field can then be swung down, the armature being retained in either the upper or lower half at pleasure. As will be seen, the motor can be put in condition for inspection in this way without touching the suspensions.

The No. 70 motor is of still larger capacity and was designed for heavy slow-speed interurban and elevated work over long lines. It will operate at 750 volts, which is an important point where the line drop is large. The poles are removable; the field winding is

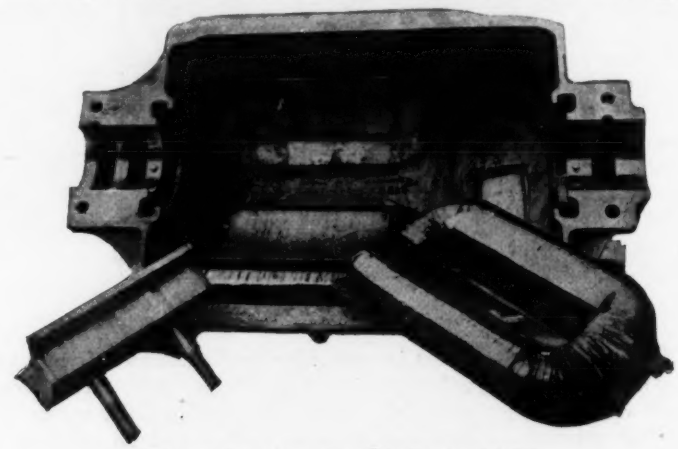


FIG. 3.—FIELD OF NO. 56 RAILWAY MOTOR.

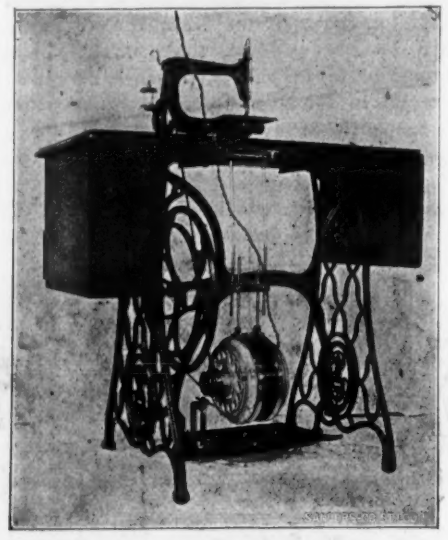
heavy, and the armature is bar wound, absolutely oil proof and exceptionally well ventilated. The bearings are extra long and are carried in separate boxes and lubricated on both sides of their entire length. The No. 50-C. motor, which is the largest of the company's standard types, is designed for the heaviest railway work. In mechanical design it is similar to the No. 70.

New Automatic Telephone.

An automatic telephone, invented by James C. Slater, of St. Louis, has recently been introduced in that city by the Slater Automatic Telephone Company. This invention, for which letters patent (No. 637,759) were issued Sept. 12 this year, is said to be a radical departure from all its predecessors, being electromechanical and constructed in a manner which makes each instrument, so to speak, a separate plant. Any chance derangement to a telephone affects that one only, thus leaving the other in unimpaired service. The automatic connecting device is electrically released, mechanically driven and exceedingly simple. The system of wiring is unique, being essentially different from any heretofore devised. This telephone is absolutely non-interfering, consequently as many conversations may be carried on simultaneously as there are pairs of instruments. A plant has been installed at the Anheuser-Busch Brewing Association in St. Louis, and it is said to be operating perfectly, and meeting the most rigid requirements. In large manufacturing concerns, wholesale houses and small towns where the cost of maintenance prohibits a central exchange system the Slater automatic telephone, it is claimed, will fulfil all the necessities.

Induction Sewing Machine Motor.

The accompanying illustration shows an Emerson induction motor attached to a family sewing machine. The power is transmitted from the motor to the machine by means of a belt which runs slack or tight according to the tension placed upon it. Since the motor is in continuous operation, the stopping and running of the machine is effected by slackening and tightening the belt, and the variation in the belt tension is effected by moving the motor itself through the instrumentality of the pedal. The motor is so hung from the frame of the sewing machine that foot pressure on the pedal moves it in such a manner as to tighten the belt and consequently operate the machine, while the release of the foot pressure causes the motor to automatically swing back, thus allowing the belt to slip. The machine then stops. Any degree of speed between the extreme limits can be obtained, according to the amount of pressure applied to the pedal. This is the only practicable way of attaching these small induction motors to sewing machines, as they are not designed to start under full load. Hence the necessity of keeping the motor running continuously and throwing on the load in the manner described.

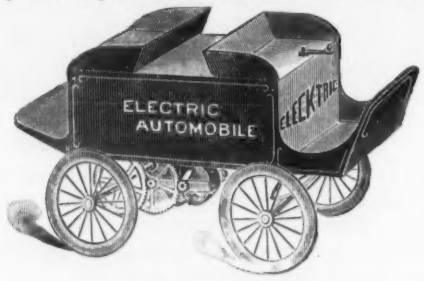


SEWING MACHINE MOTOR.

The motor takes current in proportion to the amount of work being done, or at the speed at which the machine is running, consuming little energy when the machine is not in operation. The motor has neither commutator nor brushes to look after, and no small parts requiring adjustment or repair, and is for these reasons particularly well adapted for this class of work. It is manufactured by the Emerson Electric Manufacturing Company of St. Louis, Mo., and being designed especially for family sewing machine, will not give satisfactory results for factory work.

Toy Electric Automobile.

An interesting toy for the Christmas season is an electric automobile, of which we give an illustration herewith. The motive power is furnished by two dry batteries concealed in the body of the vehicle. These may be very easily removed when exhausted and new cells substituted, obtained from any dealer in electrical supplies, the cells being of standard size.



SMALL AUTOMOBILE.

The electric motor drives the rear wheels through double-reduction gears, as shown in the illustration. The front axle is pivoted, and the lever may be set at any desired angle. Continuously the battery will drive the wagon about four hours, which duration may be extended if it is operated only at intervals as would naturally be the case. The weight of the automobile boxed, with its batteries in place, is ten pounds. The manufacturers are the Knapp Electric & Novelty Company, 125 White Street, New York.

Motor Starting Apparatus.

The motor-driven starters described and illustrated below are connected either by belt or sprocket chain to any part of the motor, or mechanism driven thereby, which will furnish the proper speed for which the starter is designed. The latest models employ a new electromechanical movement which is simple and durable and at the same time enables the construction of apparatus to suit a wide range of speed. These devices are perhaps better known as Whittingham motor-driven starters, and are manufactured by the Automatic Switch Company, Baltimore, Md.

Fig. 1 shows a non-reversible automatic starter. This is belt-driven and employs a special form of rack and pinion for the operation of the contact arm. This type of starter is particularly applicable for the operation of direct-connected looms, lathes, drill presses, etc., and by its use comparatively large motors may be safely handled with a simple make-and-break switch.

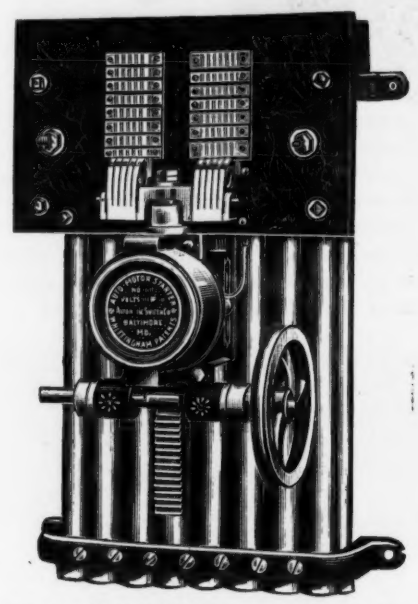


FIG. 1.—NON-REVERSIBLE STARTER.

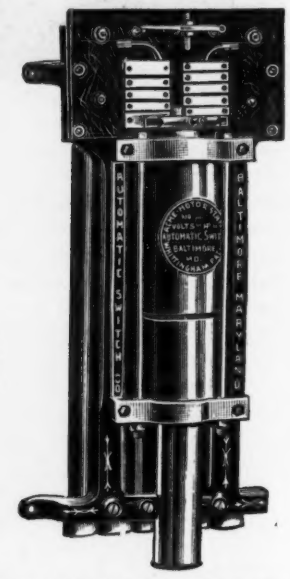


FIG. 2.—ACME SOLENOID STARTER.

The Acme starter (Fig. 2) is operated by a solenoid employing a special form of winding which relieves the magnet from the strain of full voltage, while the apparatus is in use. This instrument is useful in connection with service of a light, intermittent character, such as house service pumping, small belted elevators, etc. It is made in capacities as high as 10-hp.

The principal advantages claimed for these starters are that they cut out the resistance in direct proportion to the speed of motor acceleration, by means of positive mechanical movement, which is capable of operating heavy metallic contacts, and that the release is automatic upon the cessation of current and instantaneous upon the opening of the motor switch.

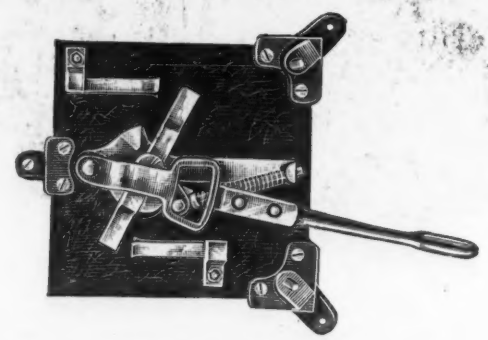


FIG. 3.—TANK SWITCH.

The apparatus shown in Fig. 3 is a quick-acting tank switch for the control of water level in open tanks. It effects a quick positive

make-and-break of the circuit through the medium of a compression spring, which acts with a hammer below on either side of the dead centre to throw the switch blade. It is operated by stops set at proper distances on the float rope, which passes through an opening at the end of the handle. It will operate in any position and requires little power to move the handle.

Some Whitney Measuring Instruments.

The necessity for instruments for the measurement of the output of dynamos and stations is unquestioned; and since instruments are a necessity, it follows that they should be as accurate as possible in their indications.

The instruments referred to below are a few of those manufactured by the Whitney Electrical Instrument Company, of Penacook, N. H., for which Messrs. Machado & Roller, of New York, are the general sales agents.

The dynamometer type of wattmeter for direct and alternating current is claimed to be a true dynamometer, and for that reason reads directly on any power factor. Experiments with wattmeters of different types have shown that where there is a variation in the angle made by the pressure coil with the stationary coil, the mutual induction introduces a variable error with fluctuating power factors. The Hoyt dynamometer avoids this, as the relative position of the coils is always the same when readings are made. Further than this, the dynamometer type is valuable in that, provided the armature and index pointers are on zero simultaneously when one current is passing, the parts must of necessity be in the same relative position that they had on calibration and the instrument is hence accurate throughout its range. On the wattmeters, dynamometer ammeters and combination direct and alternating-current ammeter, means are provided for effecting this zero adjustment from the exterior.

The alternating-current milliammeter made by this company is especially suited for use in electrotherapeutic work as well as on transformer testing. Another class of meters that is worthy of special mention is the pocket type of voltmeters, ammeters and milliammeters (Fig. 1). These diminutive instruments are sufficiently compact to allow their movement being contained in an ordinary watch case. They are not gauges, but have regular permanent mag-

FIG. 1.—POCKET TYPE VOLTMETER.

net movements and are built with jewel bearings and on the same principle as the regular portable instrument manufactured by the Whitney Company. The scales of the pocket instruments, as well as all the other Whitney apparatus, are hand-drawn, after comparison with the regular standards.

Another new departure is the yacht type of instrument, the chief features of which are its compactness and handsome appearance. It measures 7 inches over all in each direction, and has the company's standard permanent magnet movement.

In the alternating line the transformer type of instrument (Fig. 2) is among the latest productions. It is a single-turn heavy-current transformer, with broad, flat terminals adapted to be bolted directly to the busbars. The leads to the instrument are of light, flexible cords of any desired length. The Whitney Company has built a number of these instruments during the past year of 4000, 8000 and 10,000 amperes capacity, and has just shipped one of 15,000 amperes capacity. They are all said to be performing very severe duty, such,

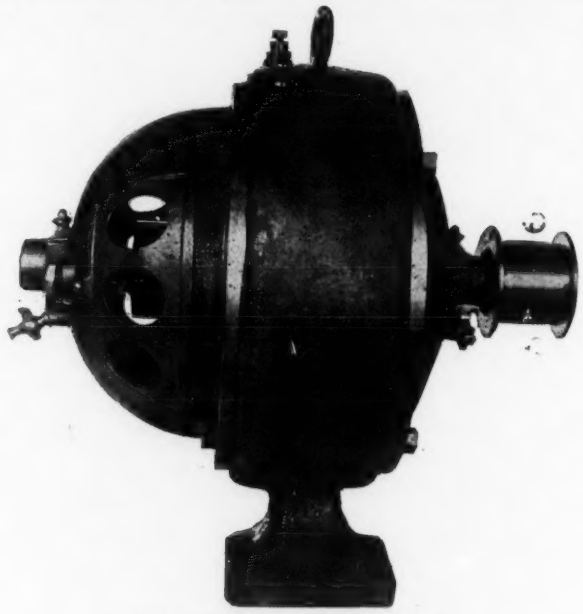
FIG. 2.—TRANSFORMER TYPE INSTRUMENT.

for instance, as electric furnace work, where the loads fluctuate violently, but so far a single case of a bent needle has not been reported.

Onondaga Direct Current Motor.

The motor illustrated herewith has been designed by the Onondaga Dynamo Company, Syracuse, N. Y., to meet a demand for a machine which shall be efficient, although compact; dust-proof, although not airtight, and non-sparking and noiseless It is made in various sizes and adapted to a great variety of work.

These motors can be placed on the floor, side wall or ceiling, and from any of these positions will run either at slow or high speed, directly belted or back geared. The hoods which support the bearings afford protection to the armature and fields, and are provided with



SIDE VIEW OF ONONDAGA MOTOR.

doors which afford easy access to the commutator and brushes. The brush holders, in which carbon brushes are used, are of very neat design and afford a perfect contact at all times. Connections are made with the terminals by leads, all of which are inside of the motor.

Machines of this type are built from one-half up to and including 16-hp. Up to 5-hp they are of the bipolar type, but above this size are multipolar. They are built to run on the usual 110, 220 and 500-volt circuits. These motors are particularly applicable to printing presses, for book binders, news offices, tailor shops, planing and saw mills, groceries and meat shops, wood working establishment and machine shops, elevator and crane work, ventilating fan work and many other places.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was short, owing to the closing on Saturday by the Exchange out of respect to Vice-President Hobart, but by Friday there was a sharp and distinct rally, and the showing of a large increase in the bank reserves has made things far more active and cheerful. During the week, 2940 shares of Western Union were sold, closing at 88. Large dealings in General Electric carried it up to a record price, namely, 131½, and after transactions in 21,262 shares, it closed at 129¼, a net gain for the week of 3⅝. There were rumors of buying by Siemens-Halske interests, and some curious reports are floating around as to an effort in that quarter to consolidate General Electric and Westinghouse, while, per contra, Mr. Coffin is credited with a recent effort to buy up Siemens-Halske. On sales of 7138 shares, Metropolitan Street Railway sold off two points, down to 193½, and on dealings in 63,679 shares, Brooklyn Rapid Transit stood firm at 89⅛. In Boston, American Bell Telephone closed at from 360-363; Erie Telephone, 108-109¼; New England, 142-144; Mexican, 3¼-3½; Westinghouse common, 45¼; preferred, 64-65; West End Railroad, 93½; Boston Elevated 104½. In Chicago, National Carbon preferred was quoted at 84¼; Union Traction common, 27¼; preferred, 80; Lake Street Elevated, 16½; West Chicago, 117½; Metropolitan Elevated common, 29½; preferred, 82½. In Philadelphia, Electric Storage Battery was active, and common, after being offered down to 108, moved up rapidly to 120. Philadelphia Traction was quoted 96½; Union Traction, 40⅞; Electric Company of America, 14¾. In the New York outside market, Electric Axle Light & Power was active all the time and closed at 7 bid. Electric Vehicle common closed at 75-85, and preferred 100; New York Elec. Veh. Trans., 13¾-14; New England, 7½-8; Illinois, 3½-4; Electric Boat, 20½-21½ common and preferred, 40.

NORFOLK, VA., CONSOLIDATION.—The long contemplated deal by which the Virginia Electric Company, the Norfolk Street Railway Company and the Ocean Valley Railway Company were to be consolidated has been consummated. The combine represents an actual capital of $1,050,000. The Berkeley electric light plant, which is owned by the William syndicate, and the large plants at Huntersville and Oakdale are to be transferred to Norfolk, where preparations are in progress for the establishment of a plant with a capacity for supplying this entire section with electric power and lights. The syndicate owns the Norfolk gas plant. Plans are being matured for extending the holdings and the operations of the syndicate, which is composed of Richmond, Norfolk, Baltimore and New York capitalists. Those in authority refuse to discuss the matter for publication.

CHICAGO EDISON COMPANY.—A special despatch from Chicago of November 27 says: "The Union Traction Syndicate, which has figured on purchasing the Chicago Edison Company, have given it up. They had 23,000 shares out of 24,880 shares necessary for control, and many more shares promised. The price on the stock was satisfactory, but there was opposition in the local field to a consummation of the deal which induced the eastern people to withdraw. The company's plant will be enlarged, and there is to be a new issue of stock of $500,000 to $1,000,000 in the near future. This was authorized at the last annual meeting. The money is to be used for extensions and betterments."

RAILWAYS COMPANY GENERAL.—It is stated by the Railways Company General people that at the close of the first six months since the company began operations a statement of earnings will probably be issued and made public by the company. Of the 500,000 shares of capital stock of the Michigan Traction Company, the newest property acquired, 100,000 shares will be held locally around Kalamazoo and Battle Creek, Mich., thus insuring a local interest in the properties, which it is thought by the new owners well to retain.

CHICAGO NORTHWESTERN.—A meeting of stockholders of the Northwestern Elevated of Chicago will be held December 29 for the purpose of authorizing a new mortgage. The mortgage will secure a total issue of $5,000,000 40-year 5 per cent. first mortgage gold bonds, to take the place of those issued under the mortgage of 1894.

LOGANSPORT RAILWAY BONDS.—W. N. Gray, representing eastern capitalists, has succeeded in floating, so it is reported, $2,500,000 5 per cent. bonds of a railroad company which proposes to build an electric line between Indianapolis and Logansport. It is also agreed to absorb the present Logansport Street Railway system, paying $175,000 for it.

Commercial Intelligence.

THE WEEK IN TRADE has been marked not by a halt in activity but by a welcome halt in the advances of raw material, although even now we have to record an advance in crude rubber, an article in the electrical arts, the price having gone up anywhere from 2 to 5 cents per pound. In view of the shortage of supply it is thought that this advance may be maintained. All of the electrical factories report themselves busy with an excellent inquiry. Some of the dynamo and motor builders have been approached by a Mr. Otto Banner, whoever he may be, with a proposal to consolidate. He is a sign of the times, and not a rare one. The business situation in general is strong, and the gross earnings of some 70 roads for the second week of November show a gain of 12 per cent. Bank clearings are lighter, owing to a reduced speculative activity, there being in a total of $1,874,397,029, a decrease of 7.6 per cent. from last week, but a gain of 41 per cent. over this week a year ago and of 77 per cent. over 1897. Compared with corresponding weeks of the years from 1893 to 1896, present bank clearings are doubled, while as compared with 1892 the increase is nearly 65 per cent. Business failures tend to increase slightly, as usual at this period, and number 202 for the week, as compared with 199 last week, 182 in this week a year ago, 233 in 1897, 296 in 1896 and 288 in 1895.

EXPORTS OF ELECTRICAL GOODS.—New York shipped electrical goods during the week ending Nov. 25 to the following countries: British West Indies, 93 packages electrical material, $1557; 1 case electrical material, $20. Berlin, 112 packages electrical material, $8,740. British possessions in Africa, 33 cases electrical material, $34,257. China, 8 cases electrical material, $1218. Cuba, 8 cases electrical material, $519; 3 cases electrical machinery, $209. Copenhagen, 4 cases electrical material, $231. Christiana, 1 case electrical machinery, $50. Central America, 22 cases electrical material, $277. Ecuador, 3 cases electrical material, $932. Glasgow, 1 case electrical material, $20; 1 case electrical machinery, $25. Havre, 2 cases electrical machinery, $300. Hull, 7 cases electrical material, $759; 12 cases electric motors, $400. Liverpool, 274 cases electrical material, $21,560. London, 16 cases electrical machinery, $1200; 112 cases electrical material, $20,416. Moscow, 8 cases electrical material, $750. Marseilles, 472 cases electrical material, $36,333. Mexico, 365 cases electrical material, $2687. Newfoundland, 24 cases electrical machinery, $342; 25 cases electrical material, $234. Odessa, 2 cases electrical material, $111. Porto Rico, 8 packages electrical material, $180. Santo Domingo, 5 cases electrical material, $47. Southampton, 10 cases electrical material, $100; 16 cases electrical machinery, $270. Venezuela, 2 cases electrical material, $13.

PACIFIC CABLE.—It is understood that one or two American companies are getting ready to build the Pacific cable, which will undoubtedly be subsidized in some form by Congress, that body in turn requiring the cable, if possible, to be built in the United States. The bill to be introduced in behalf of the Pacific Cable Company provides that if the United States Government will contract to use the cable for twenty years and pay a subsidy of $400,000 a year for this period, the company will begin construction at once from San Francisco to Honolulu, by Guam to Manila, and from Guam to Yokohama. It would be agreed that the rates for private messages from San Francisco to Yokohama should not exceed $1 per word. The present rate, by the Eastern Telegraph Company is $2.27 per word, and by the Great Northern it is $1.86 per word. The same rate of $1 would prevail to Manila, as compared with $2.47, the present rate. The cable would be free to the government for twenty years, and thereafter cost half the prevailing rates. The president of the Pacific Cable Company is James A. Scrymser, president of the Mexican Cable Company and the Central & South American Telegraph Company, operating 14,000 miles of cable. E. L. Baylies is vice-president.

ELECTRIC LIGHT IN BUENOS AYRES.—The authorities of Buenos Ayres are perfecting a scheme for the municipal lighting of the outskirts of that city with arc lamps and supplying a cheap system of electrical power for industries and factories in general about the neighborhood. The plant will cost fully $2,000,000. Forty thousand feet of feeder cable and 600,000 feet of distributing cable will be required. The current will be derived from the existing generating stations or from any other that may be erected for the purpose. There is said to be at present some $75,000,000 English capital invested in various electrical undertakings throughout the Argentine Republic. Out of $48,000,000, which was spent in material and equipment, it is stated that $30,000,000 found its way to American manufacturers. Mr. W. J. Clark, of the General Electric Company, has recently been in the Republic as expert for some capitalists who are going to make further large investments there.

NEW OPENING FOR CAPITAL.—This is a topic discussed in the November "Atlantic Monthly," by Mr. C. A. Conant, who shows how interest has fallen from 6 to 4 per cent. and even lower. He says: "The accumulation of saved capital is now so much more rapid than it was even a quarter of a century ago, and the world is so much more completely equipped with the machinery of production, that something more than a new invention or an important war will be required permanently to raise the rate of interest. There are indications, however, of several possible openings which may absorb surplus savings and afford a moderate return for several decades to come. One of these is the universal application of electricity as a motive power; a second is the extension of railroads over the undeveloped countries of Africa and Asia; and a third is the equipment of these countries with the machinery of production. These openings for capital promise to absorb many millions within the next ten or twenty years."

MR. O. H. BALDWIN, the managing director of the British Westinghouse Company, has arrived in Pittsburg from London, England. While discussing the operations of his company in England, he remarked: "Since our incorporation some three months ago we have been awarded contracts, the profits on which would enable us to pay nearly a 5 per cent. dividend. As the capital of the British Westinghouse Company is $7,500,000, made up of $5,000,000 preferred and $2,500,000 common stock, this would mean net earnings at the rate of $1,500,000 per annum, equal to 20 per cent. on the capital stock. We are pushing the work on our new factory at Trafford Park, Manchester, as fast as possible, but in the meantime our orders are filled from the East Pittsburg works. As to the scope for the sale of electrical machinery in England, it is unquestionably unlimited. The people in Europe have only just awakened to the varied possibilities of the application of electricity, and the American designs enjoy the best reputation."

HOW IT STRIKES A GERMAN.—The *Tageblatt* prints an interview with Privy Councillor Loewe, who was a German delegate at the Philadelphia Trade Congress, on the impressions he gained during his visit. Herr Loewe found the economic condition of the United States most flourishing, especially in the marvelous development of electrical industry, and the Americans far ahead of Europeans in the use of electricity as a substitute for human labor. All natural forces, he says, have been made use of for the production of electric force, the greatest being the Niagara Falls. Electric tramways and railways are far ahead of those in Europe. Herr Loewe, who is himself largely engaged in electrical enterprises, is convinced that if Germany does not want to be left behind in competition for the world's trade she must make a better use of electricity.

NEW HAMPSHIRE POWER PLANT.—The Manchester Electric Company has bought the entire Garvin's Falls Power Company, and will develop the property at once. The old pulp mill is to be pulled down, the pulp business dropped, and a fine, modern power house will be built which will furnish current not only for lighting and street railway work, but for various industries throughout a large area. The Merrimac River takes a drop of 30 feet at Garvin's Falls, and it is estimated that at least 5000-hp is available. The Manchester Company will be in the market at once for its equipment, and Mr. J. Brodie Smith will now have in his hands, as general manager, the active direction, under the new régime, of the Manchester Electric Company, the Manchester street railway and the Garvin's Falls property. Mr. Jewell, who has been superintendent of the old Garvin's Falls lighting plant, which has a capacity of about 4000 lamps of 16-cp, will be retained as superintendent by the new management.

ITALIAN SHOWROOMS IN PORT SAID.—J. F. Monaghan, vice and acting consul, writes from Chemnitz as follows: German technical papers are calling the attention of local manufacturers to the efforts which Italy is making in the east to procure a market for her goods. She has established a display house at Port Said, wherein she shows to the eastern world the cotton products of the looms of Lombardy, the porcelain and glassware of Milan, the silk goods of Como, etc. This enterprise was established two months ago and has been a complete success in every respect. The manager, a man well posted, has his living apartments free, with an allowance of $97.33 a month, and receives 50 per cent. of the net earnings. Orders worth $7,720 have already been taken. This plan has been suggested to our export associations by a number of United States consuls.

TROLLEYS FOR BRITISH GUIANA.—A syndicate has been organized in Canada for the purpose of building an electric road in Demerara, British Guiana. The projected line will be an overhead trolley. It will be ten miles in length. Many of the same people are interested as are in the American-Canadian syndicate, formed with the object of operating 100 miles of trolley line in Sao Paulo, Brazil, where a large hydraulic plant is now being erected some twenty miles out of that city. F. S. Pearson, consulting engineer of the Metropolitan Street Railway, who acts in a similar capacity, has just returned from Brazil, where he has been superintending the construction of the trolley and hydraulic plant. Mr. Pearson has now under consideration the awarding of a $700,000 contract for electrical equipment.

SPRAGUE ELECTRIC COMPANY, which is now making a determined push with its "detail" business, including dynamos, motors, interior conduit, fans, switchboxes, switches, etc., has decided to move its offices from Broad Street back to the old factory in West Thirty-fourth Street, so as to get into closer touch with those important branches of its growing trade, which has now overspread the four quarters of the globe. Occupancy of the new offices will begin about the middle of December, when Mr. Allan Bakewell, the energetic general manager and second vice-president, promises to have things in good shape. He has associated with him Mr. D. C. Durland as assistant to the general manager, bringing him in from the Watsessing factory, and Mr. C. P. Geddes fills the offices of secretary and treasurer.

FAN MOTORS.—A plan has been proposed, and a committee appointed, to draw up a constitution for an American Association of Fan Manufacturers, the object being mainly to uphold prices o nthis useful appliance. It is estimated that some forty or fifty thousand electric fans are sold annually in this country. The chairman of the provisional committee is Mr. H. B. Cassel, of Marietta, Pa., and some fourteen concerns are interested. Mr. David Chalmers, Manager in New York of the Holtzer-Cabot Electric Company, has been made Acting Secretary of the Association. It is understood that prices will be advanced forthwith in keeping with the advance in cost of raw material, which means 40 or 50 per cent.

A PARIS EXHIBIT.—There has been shipped from East Berlin, Conn., about 27 cars of structural material from the works of the Berlin Iron Bridge Company, consigned to the United States Commission at Paris. This trainload of material is for the steel framework of a typical American machine shop to be used exclusively by the American exhibition of iron and woodworking machinery at the fair of 1900. This material comprises a building 343 feet long and 74 feet wide. It will be equipped with motive power in order that American exhibitors may show their machinery at practical work and at the same time make an exhibit of a typical American machine shop with all modern appliances.

J. G. BRILL COMPANY, of Philadelphia, has just secured an order from the Union Traction Company, of that city, for 150 cars, 110 of which are 12-bench open cars with an aisle through the center. 110 of which are 12-bench open cars with an aisle through the centre. All will have Union Traction Company's standard finish, the same style of car and the same finish as furnished to the Union Traction Company by Brill during the past summer. The order for the motors has gone to the Westinghouse Electric & Manufacturing Company, who will put Westinghouse No. 38 motors on the 12-bench cars and four Westinghouse No. 3 motors on the 14-bench cars.

RAILS FOR GLASGOW.—It was announced at the offices of the Federal Steel Company last week that the company has just closed a contract to furnish a large supply of street railway materials in Glasgow, Scotland, the total value of which aggregates £500,000. The order includes girder rails, frogs, switches, and the like. Auditor Shearson, of the company, speaking of the contract, says that the material will be supplied from the Lorain Steel Company's shops. The girder rails will be manufactured at the Lorain plant, while other work will be done at the Johnstown plant.

BULLOCK MOTORS FOR ENGLAND.—The Manchester *Sporting Chronicle*, England, has placed an order through Messrs. Bergtheil & Young, of London, English agents of the Bullock Manufacturing Company, for two 150-kw engine type generators. These generators are for supplying light and power in the *Sporting Chronicle* establishment. This concern has already in operation five of the Bullock 50-hp teaser equipments operating Hoe newspaper presses.

THE WESTERN ELECTRIC COMPANY is installing three 70-hp motors in Schlesinger & Mayer's building, Chicago. These motors are especially designed to drive the pumps for the elevators, and are to work against a constant pressure of water at all speeds. The speed variation, which is from 175 to 350 revolutions per minute, is governed by an automatic controller which cuts in or out various sections of series field winding.

AMERICAN IMPULSE WHEEL COMPANY, 120 Liberty Street, New York, have lately been doing an excellent export trade, and now report a nice order for water wheels to run a mill in South America. Another recent order was from Sweden.

THE C & C ELECTRIC COMPANY has of late made a number of exports, and reports trade specially good with England. One customer, in Liverpool, has recently bought a 125-kw direct-connected generator from it.

Special Correspondence.

NEW YORK NOTES.

New York, Nov. 28, 1899.

MR. WM. JACOBS has opened a supply house at 26 Vesey street, New York. His company is the Yorkville Electric Construction Company. The special features of their business being electric bells, signs, burglar alarms and telephones.

TRADE CREDITS.—The New York Electrical Trades' Association will hold its fourth annual meeting on Wednesday, Dec. 6, at the Astor House at 2 p. m. when a full attendance is requested, as an "Advance Information" plan will be presented for sareful consideration.

AUTOMOBILES IN THE PARKS.—The question of the admission of automobiles to Central Park has been decided in the affirmative. President Clausen stated, however, that the innovation would be accomplished gradually, so as to avoid possible frightening of horses.

FIRE ALARM SUBMARINE CABLE.—The fire department laid a 600-feet telegraph cable from the Bronx Borough shore to Randall's Island early last week in 11 minutes 33 seconds. This was remarkably quick work, and it was done by using a locomotive to haul on the block and tackle used.

AN UP-STATE CONSOLIDATION.—A certificate of merger of the Trenton Falls Electric Light & Power Company and the Utica Electrical Manufacturing & Supply Company was filed with the secretary of state on Nov. 20. The new company will be known as the Trenton Falls Electric Light & Power Company.

WILLIAM H. FREEDMAN, C. E., E. E., for several years tutor in electrical engineering at Columbia university, has been appointed professor of electrical engineering in the University of Vermont. To fill this vacancy Fitzhugh Townsend, A. B., E. E., has been made tutor and C. S. Aylmer-Small, E. E., assistant in electrical engineering at Columbia.

WATER POWER ON THE UPPER HUDSON.—Senator E. T. Brackett, of Saratoga, and E. L. Ashley, of Glens Falls, have recorded a deed from the Kanes Falls Electric Company to the Hudson River Water Power Company for $2,365,000 on land on the Saratoga and Warren County sides of the river, including water power, etc. Messrs. Brackett and Ashley also recorded a first mortgage of $2,000,000, executed by the Hudson River Water Power Company, to the Trust Company of America.

THE MARCONI WIRELESS TELEGRAPH COMPANY.—Articles of incorporation were filed on Nov. 22 with the secretary of state at Trenton, N. J., for the Marconi Wireless Telegraph Company. The authorized capital was $10,000,000, of which one-half is preferred stock with an 8 per cent. noncumulative dividend. The president of the new company will be Isaac L. Rice; the treasurer, August Belmont. The other officers are not yet chosen, but the names of the other incorporators are Guglielmo Marconi, London; Clement A. Griscom, New York, and Robert Goodbody, Paterson, N. J.

WM. ROCHE, 42 Vesey street, New York, the manufacturer and inventor of the well known "New Standard" dry battery, is making a special flat side cell to meet the demands for a reliable cell for automobile work. This cell is used in connection with a spark coil for gasoline and kerosene engines, the size of cell is the same as the French cell, 7x2½x2¼ over all. Mr. Roche is now turning out 4000 batteries per day and to facilitate the handling of his extensive and rapidly increasing export trade he has opened a branch sales office at 46 Clerkenwell Road, London, England, in charge of R. E. Howard.

THIRD AVENUE ELECTRIC CARS.—The electric conduit system is now in operation along the full length of the Third Avenue Railway Company's lines. The cars now run over the post office loop. Traffic on this section of the road was suspended for a few days during the past week while the change-over was being effected. The cars run well, and the new long ones attract much attention. They look much like standard steam railway cars, though not so long. The seats are arranged crosswise, with an aisle down the middle of the car. The windows are large. The cars are fitted out with all the latest improvements.

FIRE TELEGRAPH SUIT.—Mr. J. E. Smith, formerly superintendent of fire alarm telegraph and electric appliances of the fire department, discharged by Commissioner Scannell on March 14, 1898, has succeeded in getting a writ of mandamus. Judge Gildersleeve, in the Supreme Court, issued the writ, which is peremptory and gives Smith powers of reinstatement. At the time that Mr. Smith was discharged the reason given was the abolishing of the office of which he was superintendent and the placing of it under the control and management of Chief Edward Croker. At that time there was a similar position in the boroughs of Kings and Queens, which was controlled by Superintendent Henry F. Blackwell. When Mr. Croker took control Mr. Blackwell was made an assistant superintendent in charge of Greater New York under Chief Croker, with a salary of $2500. The salary of both offices previously had been $3500. Commissioner Scannel states that the judgment would be appealed and carried to the appellate division of the Supreme Court.

Niagara Falls, N. Y., Nov. 27, 1899.

THE NEW WHEEL PIT.—The work of building the new wheel pit of the Niagara Falls Power Company has been commenced by the National Contracting Company. The work will be pushed forward with great vigor, and at the same time Contractor A. C. Douglass will carry out his subcontract that calls for the construction of the tunnel to connect the new wheel pit with the main tunnel. This connecting tunnel will be the full size of the main tunnel and nearly 750 feet long.

FATALLY SHOCKED.—On Saturday afternoon, Nov. 25, Charles Sheffield, chief electrician of the Union Carbide Company, received a fatal shock of electricity in the carbide plant at Niagara Falls. It is thought that while working about one of the big transformers he lost his balance and fell against one of the switches. The point of contact was on his head. He was found within a few minutes, but all efforts to resuscitate him failed. He was about 26 years old, and was a graduate of the McGill University, Montreal. He had been in the employ of the company for about nine months.

THE INTERNATIONAL TRACTION COMPANY has about completed the short piece of track on the Riverway between the foot of Falls Street and the New York end of the upper steel arch bridge, thus completing the entire belt line about the gorge. The track along the Riverway, it will be recalled, is laid on the State Reservation property by consent of the Park Commissioners. The road is single track at this point. The International Traction Company has also improved its car facilities at the foot of Falls Street by placing additional switches below Main Street. These improvements will be a material aid in handling the great Niagara crowds that patronize the trolleys at Niagara in summer. Now it is possible to board a car in Buffalo and have a continuous ride to Queenston, Ont.

NEW ENGLAND NOTES.

Boston, Mass., Nov. 25, 1899.

AUTOMOBILES IN BOSTON PARKS.—George Von L. Meyer, president of the New England Electric Vehicle Transportation Company, is hard at work attempting to conquer the prejudice of the local park board against automobiles.

TO DEVELOP GARVIN'S FALLS POWER.—The Manchester Electric Company has purchased the entire stock of the Garvin's Falls Power Company and will develop the property at once. J. Brodie Smith has been elected manager. The power at Garvin's Falls will be transmitted to Manchester and used to re-enforce the power of the Manchester Electric Company.

THE MALDEN ELECTRIC COMPANY, of which John S. Bartlett, J. N. Smith and E. W. Rice, Jr., were the organizers in 1888, has been sold to a party of New York capitalists. The company is capitalized at $175,000 stock and $100,000 in bonds and has $135,000 outstanding in coupon and promissory notes. The company paid dividends of 8 per cent. up to 1895, when the rate was reduced to 6 per cent., which rate it has since paid.

PENNSYLVANIA AND OHIO NOTES.

Philadelphia, Pa., Nov. 27, 1899.

APPLIED FOR A RECEIVER.—The Real Estate Trust Company, of Philadelphia, has petitioned court for the appointment of a receiver for the Carbondale Traction Company, alleging default in the payment of interest on $450,000 bonds secured by the petitioner.

THE PHILADELPHIA ELECTRIC COMPANY.—The permanent organization of the Philadelphia Electric Company has been effected as follows: President, J. B. McCall; vice-president, Wm. F. Harrity; treasurer, Wm. P. Conover, Jr.; secretary, A. V. R. Coe. The directors are: W. L. Elkins, P. A. B. Widener, Thomas Dolan, Jeremiah J. Sullivan, John M. Mack, Allen B. Rorke, Wm. F. Harrity, A. V. R. Coe and J. B. McCall.

ELECTRICAL WORKERS ORGANIZE.—The electrical workers of this city are perfecting a strong organization for the purpose of securing fewer working hours and more pay. Four weeks ago an organization was formed under the title of the Electrical Workers of Philadelphia, and it is stated that over one-third of the total number of wiremen in the city have been enrolled as members. The members contend that they are poorly paid for the labor they perform in comparison with the wages paid in other cities. Mr. Louis Spence is president of the organization.

ELECTRIC LIGHT TENDERS.—Bids for street lighting were opened last week by Director English and Chief Walker, of the electrical bureau. The Kensington Electric Light Company bid 20 cents per light per night for 325 lamps. This bid is 14 cents per light cheaper than was asked in the same territory last year. The different companies controlled by the trust made bids ranging from 28 to 35½ cents per light for the district which they have mapped out for their own. The Brush Company, which is controlled by the trust, made a bid of 30 cents per light per night for all the territory bounded by the Delaware and Schuylkill Rivers, and south of Allegheny Avenue. This includes the two districts included in the bid of the Kensington Electric Light Company. Averaging the low bid of the latter company with all the other separate bids for the territory included in the Brush Company's omnibus offer, and the Brush bid of 30 cents is lower. Seven thousand, six hundred and ninety-four street lights will be contracted for during the coming year, an increase of 680. The total cost of electric street lighting this year amounts to $825,000 in round numbers. Six bids, covering different sections of the city, were offered by the Brush Electric Light Company, in addition to the omnibus bid, and they ranged from 28 cents per light, with use of city poles, to 33 cents. The Diamond Electric Light Company bid 29 cents per light for its territory in the northeast section of the city. The Suburban bid 35½ cents for the territory covered by the Twenty-third and Twenty-fifth Wards, while the Germantown bid 35¼ cents for lights in the Twenty-second Ward. The Southern will light the territory south of South Street at prices ranging from 28 to 32 cents. For the territory west of the Schuylkill River the Powelton bid 32 cents, and 29 cents on mast arms. The Wissahickon Electric Company bid for lights in the Twenty-first and part of the Thirty-eighth Wards at 34 cents, and 23 cents for lights in the northeast section. The bids will be scheduled and the awards made.

Pittsburg, Pa., Nov. 28, 1899.

MR. SAUNDERSON MORRIS, of the Philadelphia branch office of the Westinghouse Electric Company, was in Pittsburg a few days ago, visiting some of his old friends.

THE UNITED TRACTION COMPANY has just decided to spend $100,000 in Allegheny City for improvements upon its many lines, and also to make some extensions, notably from Allegheny to Avalon and Dixmont.

THE CITIZENS' TRACTION COMPANY held its annual meeting Nov. 23 and elected the following board of directors: James Verner, John G. Holmes, James J. Donnel, John B. Jackson, C. L. Magee, H. S. A. Stewart and Melchior S. Beltzhoover.

MR. JOSEPH WYNGAARD, the Belgian electrician, who came to this city some time ago and became so violently insane here that he had to be confined in the local asylum, was discharged this week, and accompanied by a friend he returned to his native land.

MR. FRED DE LAND, the local representative of the Federal Telephone Company, states that his company has now concluded all arrangements for a direct trunk line from St. Louis to Washington, D. C., by securing telephone franchises and complete plants in St. Louis, Indianapolis, Columbus and Wheeling.

STREET RAILWAY EMPLOYEES' RECEPTION.—The conductors and motormen of the Consolidated Traction Company will hold a reception on Dec. 12. The following committee of arrangements has been appointed: E. E. Hill, M. McQuaide, E. Sample, Jacob L. Stump, F. J. Denman, D. H. Duffy and John L. Sauer.

THE PITTSBURG REDUCTION COMPANY, probably the largest producer of aluminum in the world, has let a number of contracts for the erection of a power plant at Shawinigan Falls, on the St. Maurice River in Canada. Eleven electric generators are to be made by the Westinghouse Electric & Manufacturing Company to be installed at this plant, and the Reduction Company intends to use the entire output for the Canadian trade exclusively.

THE DEMAND FOR AMERICAN MANUFACTURES.—The growing demand for American made goods is, perhaps, nowhere more strikingly demonstrated than in this city, one of the largest manufacturing centers of this country. Every day the hotel registers contain names of travelers from all over the world, who have come here to buy steel from Carnegie, electrical machinery from the Westinghouse Electric & Manufacturing Company, locomotives from the H. K. Porter Locomotive Works, oil well machinery from the Oil Well Supply Company, steam engines from the Westinghouse Machine Company, glassware from the American Glass Company, air brakes from the Westinghouse Air Brake Company, aluminum from the Pittsburg Reduction Company, iron and steel pipes from the National Tube Works. As an example, Guillermo Lozano, from the City of Mexico, was here this week as a representative of Mexican capitalists to form a business connection here with a number of manufacturers to sell their goods in his native country and replace the influence of the German and English importers, who have hitherto enjoyed a monopoly of this trade. Mr. Lozano stated that his country had awakened to the fact that American manufacture is better than any other, and that his people had come to prefer it. Mr. K. Takeda, a Japanese mining engineer, came here to inspect mining machinery, which he intends to use in equipping some large copper mines in his native country.

Cleveland, Ohio, Nov. 25, 1899.

MR. WASHINGTON HYDE has succeeded E. J. Clapp as president of the Warren-Niles Telephone Company, the latter having become general manager. Jules Vantrot, Jr., has been elected vice-president.

A MORE COMPREHENSIVE NAME.—The Youngstown Gas Company, of Youngstown, has changed its name to the Youngstown Gas & Electric Company, and has increased its capital stock from $300,000 to $450,000.

MR. EUGENE J. BARNEY, for the past thirty-three years president of the Barney & Smith Car Company, of Dayton, has resigned his position and retired from business. It is reported that Col. J. D. Platt, the present vice-president, will succeed him and that A. M. Kittridge, now superintendent, will become general manager.

NEW ELECTRIC RAILWAY.—Davis King and W. A. Garver, of Canal Dover, backed by Philadelphia capitalists, have secured franchises and rights of way for an electric line between Canal Dover and Massillon. With the completion of a line from Massillon to Akron, also projected, this would give a complete line from Lake Erie to the Ohio River at Wheeling, the links between Wheeling and Canal Dover being already in operation or in process of construction.

DAMAGE TO WATER PIPES BY ELECTROLYSIS.—The city of Dayton has brought suits against the Cincinnati & Miami Valley Traction Company, the Oakwood Street Railway Company, the Peoples Railway Company and the City Railway Company, operating electric lines in that city. A mandatory injunction is asked for commanding the defendants to adopt a new system of traction and such devices as may be necessary to prevent the escaping and returning electricity from damaging the water pipes.

ELECTRICAL INDUSTRIES IN OHIO.—A report given out recently by Secretary of State Kinney shows that the development in electrical lines easily leads all others for the fiscal year just closed. Sixteen electric light and power companies, with a capital of $1,609,000; 42 electric railways and consolidations, with $15,606,000 capital, and 57 telegraph and telephone companies, with $2,222,000 capital, were incorporated. Increases of capital stock were made as follows: Electric light and power, $817,000; electric railway companies, $2,030,000, and telegraph and telephone companies, $1,510,500. The aggregate capitalization for the year was $119,077,710, as against $49,149,150 for the year previous.

NEW TELEPHONE BUILDING.—The handsome new Electric Building now under process of construction in Cleveland, was transferred a few days ago from the Electric Terminal Company to the Cuyahoga Telephone Company. The revenue stamps on the deed showed the property to be valued at $75,000. Immediately after filing this deed, the Cuyahoga Telephone Company filed a $3,500,000 mortgage upon the Electric block and all the rights of way and telephone lines in the city. The mortgage was given to the Dime Savings & Banking Company of this city, and is payable in twenty years at 5 per cent. It is reported that the general offices of the Cleveland Electric Railway Company, of which H. A. Everett is also president, will be removed to the Electric Building. The exchanges of both the Cuyahoga and the United States telephone companies will also be located there.

TELEPHONE IMPROVEMENTS.—J. P. McKinstry, vice-president of the Cleveland Bell Telephone Company, received the information a few days ago that the management of the Erie system of telephone companies had appropriated an additional $10,000,000 for expenses during the years 1900 and 1901. Of this amount, $2,000,000 has been allotted to Cleveland. Previous appropriations for the Cleveland district, which comprises the city and Cuyahoga county, amounted to $3,000,000. During the past year the local company has enjoyed an unprecedented growth. From 5000 telephones a year ago, it now has over 11,000 in daily use. Based upon this growth it is figured that the company will have 20,000 instruments by the end of 1901; hence it will require every cent of the amount mentioned for extensions and improvements. It is announced that a number of new exchanges will be erected and many of the overhead wires will be put underground. It is also proposed to extend the system throughout the county and every small village will be placed in direct connection with the city service.

THE CONTROL OF THE DAYTON TRACTION COMPANY.—A long-drawn and spirited contest for the control of the Dayton Traction Company was brought to a close a few days ago, when nearly the entire stock of the company was transferred to M. J. Mandelbaum and others, of Cleveland. Two weeks ago M. J. Mandelbaum, H. R. Newcomb and E. G. Tillotson, all prominent Cleveland business men, were elected directors of the Dayton Company. The Dayton Traction Company operates an electric railway from Dayton to Miamisburg, and it is controlled under a 99-year lease by the Cincinnati & Miami Valley Traction Company, which is also owned largely by M. J. Mandelbaum. The Cincinnati & Hamilton Street Railway, operating from Cincinnati to Hamilton, is owned by M. J. Mandelbaum, D. H. Kimberley, F. D. Pomeroy and several other Cleveland people, and it is said to be the plan to consolidate the three roads into one company. The consolidation plans, it is said, are on a broad and comprehensive basis and enough bonds will be reserved in the treasury to extend the lines further north.

Cincinnati, O., Nov. 25, 1899.

THE BULLOCK MANUFACTURING COMPANY is at present negotiating with a Japanese agency. If the arrangements are perfected the Bullock goods will be in the hands of one of the foremost concerns in Japan.

MR. SAMUEL W. GLOVER, president and treasurer of the Post-Glover Electric Company, left Thursday night for Chicago on important business for his concern, expecting to return on Monday. President Glover reports business unprecedentedly heavy and everything electrical on the boom.

MR. A. J. SCHULMAN, contractor, is finishing a complete electric plant at the St. Joseph Orphan Asylum, a $1400 outfit, and has just completed a similar plant at the building of the Sisters of the Good Shepherd in Carthage, an $800 outfit. The first was equipped with a Siemens-Halske dynamo, and the other used the Jantz & Leist machine.

THE JANTZ & LEIST ELECTRIC COMPANY have been kept exceedingly busy lately attending to purely local business, the numerous new machine tool making concerns and furniture and other industrial establishments going up in the north and west end furnishing opportunities for booming local business that have not existed for a long time.

MR. THOS. G. SMITH, electrical engineer and contractor, is wiring the plant of the Harvard Piano Company in Dayton, Ky., removed from Boston recently. Mr. Smith is also preparing plans and specifications for the electric equipment of the Blymyer Iron Works, Spring Grove Avenue and Township Street, and has also in hand plans for the complete electric equipment of the plant of the J. Weller Company, a new factory, in the west end.

TO ABANDON EFFORTS FOR A FRANCHISE.—It is probable that the projectors of the Cincinnati & Aurora (Ind.) Street Railway Company will abandon their efforts to get a franchise for the proposed route which entails so much opposition in the use of a bridge between Cleves and Harrison. The original route is between Cleves and Elizabethtown, and it is quite likely the company will take this one. The matter is now before the county commissioners.

ELECTRIC POWER FOR A FACTORY.—Electrical Engineer Bert L. Baldwin has in hand the mechanical engineering features of the United States Card Playing Company's new plant in Norwood. The Bullock Company will furnish the generators, and the Buckeye Engine Company, of Salem, the engines. The entire plant will be run by electric power. The equipment will include one 150-hp and a 300-hp engine and generator. The contracts for motors and wiring are not yet let.

THE SUBURBAN ELECTRIC COMPANY, of Covington, is in the throes of a tripartite difficulty, so to speak. Differences of opinion as to management brought about a quarrel which resulted in attempts to have a receiver appointed at Newport, an assignee at Covington, and still others prepared a coup by filing an involuntary petition in bankruptcy at Louisville. The last petition is signed by the Standard Oil Company, the Post-Glover Company and Insurance Agent Ed E. Walker, of Covington. The last move will undoubtedly prevail. The assignee, Ben Bramlage, and Receiver J. J. Youtsey both claim to be in charge, but they agreed to allow Superintendent J. C. Heaton to conduct the business until a final decision of the court settles the controversy.

ROBERT CAMPBELL, of Mexico City and Vaca Tecas, Mexico, has been taking contracts to represent a number of Cincinnati concerns in the City of Mexico as manufacturers' agent. Mr. Campbell speaks English and Spanish fluently and is apparently well informed. His plan contemplates a cash payment by manufacturers, which constitutes their initiation fee. He then proceeds to push their goods in Mexico, and when $500 worth of orders are sent in he is entitled to another payment. He has made contracts with the Northern Electric Company, of Cleveland; the Gordon Battery Company, of New York City; the American Electric Heating Company, and the F. M. Watkins Company and the Carlisle & Finch Company, of Cincinnati, and with other high class concerns.

WESTERN NOTES.

Chicago, Ill., Nov. 25, 1899.

THE METROPOLITAN ELEVATED RAILWAY COMPANY has received 66 new coaches, which are the balance of the lot ordered some time ago. They will go into service at once.

MR. G. G. LUTHY, general manager of the Royal Electric Company, of Peoria, Ill., is visiting Chicago this week. He reports an enormous increase in business, their factory being forced to work night and day.

MRS. JULIA MARSH JEWELL, wife of Edward W. Jewell, president of the McIntosh Battery & Optical Company, Chicago, died at her home, Nov. 21, at 4 a. m., at the age of 30 years. The deep sympathies of the electrical fraternity are with Mr. Jewell.

THE TELEPHONE TUNNEL.—An inspection of the street conduit being constructed by the Illinois Telephone & Telegraph Company has been made by City Engineer Ericson and Consulting Engineer MacHarg. The engineers reported to the mayor that the tunnel, so far as work has progressed, is being constructed as well as can be expected. About 75 feet of the tunnel has been completed and lined with concrete.

THE FARR TELEPHONE & CONSTRUCTION SUPPLY COMPANY, of Chicago, is sending a very useful and attractive catalogue to its many friends and customers throughout the electrical trade. The catalogue consists of 82 pages, handsomely illustrated, and contains valuable information for electrical supply and telephone men. It is a result of the ingenuity of Mr. Charles Farr, president of the company, and was evidently compiled with great care.

THE ILLINOIS ELECTRIC COMPANY, Chicago, reports that it continues to meet with much success in the electrical supply business, and has recently been forced to increase its space, by taking two more floors for its factory. The company during the past season sent out a magnificent general catalogue, as well as a telephone catalogue. It has just been appointed western representative for the Peerless transformer, and immediately sold eighteen of them to the Wooster Electric Light & Power Company, of Wooster, Ohio.

AUTOMOBILE PLOW.—It is stated that Dr. R. J. Gatling has devised an automobile plow which he thinks may become extensively used in preparation of land for cultivation. The machine will be built on the principle of the automobile, with disk plows so arranged as to do the work of the implements now in use with greater facility and rapidity and at a greater saving. He proposes to build the machine so it can be operated by a single man. It will do the work of eight men and 12 horses. The power will be either gasoline or oil.

FAST TELEGRAPHY.—On Wednesday last Messrs. Pollak and Virag conducted experimental tests of their system of fast telegraphy. Messages were sent from this city to Milwaukee and returned from there, at the rate of 140,000 words an hour. An experiment was also made in sending messages to and from Buffalo, but the experiment was not so much of a success, for the reason that the wire was longer than had ever been used before. Ninety thousand words an hour were sent, however. Buffalo and return is a length of 1062 miles. The experiment so far as Buffalo was concerned was not completely satisfactory, owing to the absence of the necessary instruments, which had not yet arrived from New York. The tests were conducted under the supervision of Mr. J. C. Barclay, manager of the Western Union Telegraph Company. The experiments will be repeated when the instruments arrive from New York.

THE CHICAGO MICA COMPANY has purchased a large factory property at Valparaiso, Ind., and expects to occupy it by December 1. The building is 100x60 feet, three stories high and constructed of brick. Another building, 100x 40 feet, is arranged for the manufacture of "Micabond" cloth paper and "Champion" compounds. The new factory will be equipped with modern machinery and will have every facility for handling mica and manufacturing mica insulation. The Chicago Mica Company was organized a year ago with a capital of $40,000. It mines and imports mica of all grades for every use, and manufactures mica insulators under the trade name of "Micabond." The success of the company during the first year of its existence has been phenomenal. It has outgrown its Chicago factory and was compelled to look elsewhere for more commodious quarters, with the result of locating in Valparaiso, as indicated above. The officers of the company are Milton A. Snider, president; J. W. Sefton, vice-president; W. F. Hatch, secretary, and Henry E. Miller, treasurer.

Milwaukee, Wis., Nov. 25, 1899.

MESSRS. ROHN & MEYER have the contract for furnishing the electrical equipment for the Raddatz submarine boat. The equipment includes dynamo, motor, switchboard and storage battery.

THE ERIE TELEPHONE SYSTEM, which includes Wisconsin and Michigan, added 3585 subscribers to its exchanges in October. The subscribers now number 96,673, an increase of 35,930 since Jan. 1.

ELECTRIC HEARSE.—It is understood that General Manager John I. Beggs, of the Milwaukee Electric Railway & Light Company, is considering a plan for the introduction of a hearse street car, operated by a conductor and motorman dressed in black, for funerals.

PRESIDENT GLIDDEN, of the Erie Telegraph & Telephone Company, of which the Wisconsin Telephone Company is a part, has notified General Manager McLeod that $10,000,000 had been appropriated for the development of its territory during 1900 and 1901. Of this amount $2,000,000 has been allotted to Wisconsin, in addition to the $1,000,000 previously appropriated.

TO ANNUL A STREET RAILWAY FRANCHISE.—A resolution has been introduced in the Waukesha common council to annul the franchise granted recently to the Milwaukee Electric Railway & Light Company for a street railway system. The basis of the move is the alleged lack of compliance with the terms of the franchise respecting the running of trains over the entire line in the city.

WIRELESS TELEGRAPHY.—Warren S. Johnson and Charles L. Fortier, inventors of a wireless telegraph system, gave a public exhibition of its working at the Plankington House on Nov. 22 before a large number of people. Messages were sent successfully and it is claimed by the inventors that their system overcomes all the obstacles experienced with Marconi's system. They, however, stated that they did not believe it would ever replace the present telegraph system for commercial use. The Morse code is used.

THE FALK COMPANY, whose plant recently was totally destroyed by fire, has its new plant nearly completed, and has been in partial operation for the past month. Power is transmitted electrically in the most economical manner. A 400-ampere 220-volt General Electric generator furnishes current to various number and varying sizes of Milwaukee Electric Company's motors. The switchboard is notable, inasmuch, that the switches are of the Cloos high tension oil type. The Falk company is the manufacturer of the Cloos high tension specialties, such as switches and junction boxes. The company has large contracts in this country and also Europe.

THE SHEBOYGAN COUNTY TELEPHONE exchange is pushing along its extensions with much rapidity, and now the work of placing poles from Sheboygan Falls to Plymouth is completed. Another force of men is setting poles in the direction of Waldo and Random Lake. The entire force will be kept at work setting poles until prevented by frost, and then the work of stringing wires will begin. This is the start in the work of carrying out the plans of the Sheboygan County Telephone exchange, which will extend its lines to Milwaukee, via Port Washington, Cedarburg, Grafton and Random Lake, to Plymouth. An exchange will be put in at Sheboygan Falls and other points. It is the purpose of the company to establish 20 to 30 local toll stations around Milwaukee. Mr. Ferdinand, who is one of the chief promoters of the Sheboygan county exchange, is also connected with the independent companies of Neenah, Menasha, Appleton and Kaukauna. The system will ultimately embrace a toll service that will reach every city and village in the state, connections to be made with the independent telephone companies.

Minneapolis, Minn., Nov. 24, 1899.

MUNICIPAL LIGHT.—On Nov. 15 a special election was held at Hillsboro, N. D., to vote on the proposition to bond the city for an electric light plant. The proposition was carried.

NEW ARC LAMP.—It is stated that Mr. W. F. Wagner, electrician for the Superior Shipbuilding Company, West Superior, Wis., has invented a new arc lamp. As the lamp has not yet been patented details are unobtainable.

LARGE RAILWAY ENTERPRISE.—It is announced that the Des Moines City Railway Company will, next year, build an electric railway from Des Moines to Winterset, Macksburg, Greenfield and Creston, a total distance of 75 miles. President Polk and Manager Hippe have just returned from the East, where they have been financing the enterprise.

MESSRS. W. I. GRAY & CO., of Minneapolis, have recently installed a plant for the city of Princeton, Minn. The equipment consists of a 50-kw 220-volt Crocker-Wheeler generator, direct connected to a Chandler-Taylor engine. Differentially wound, constant potential arc lamps are used for street lighting. They are connected two in series across 220 volts.

Indianapolis, Ind., Nov. 25, 1899.

FIFTY MILES AN HOUR.—The Union Traction Company, upon the opening of the Indianapolis-Muncie division, will put on motor cars capable of making fifty miles an hour. These will be used on the through trains.

THE LACLEDE BATTERY COMPANY, Kokomo, Ind., has been incorporated with a capital of $25,000. The directors are Sampson W. Moon, H. B. Moon and J. F. Kerlin. The company will manufacture batteries, carbons and electrical apparatus and appliances.

A NEW ELECTRIC LINE AGITATED.—The advisability of constructing an electric railway from New Albany to Paoli is being agitated. The proposed line will be 40 miles long, and pass through Mooresville, Galena, Greenville, Palmyra, Fredricksburg, Hardinsburg and Chambersburg.

ELECTRIC PLANT SOLD.—The Commercial Electric Light plant, of Columbus, has been sold to satisfy a mortgage of $1,000. John D. Crumps is the purchaser; consideration $4,407, he assuming the mortgage. He will now consolidate this plant with the Citizens' Electric Light plant, of which he is sole owner, and promises all night service.

ELECTRIC RAILWAY BONDS AUTHORIZED.—The issue of $500,000 in bonds has been authorized by the Chicago, Hobert & Valparaiso Electric Railway Company, to provide for the construction of the road from Valparaiso, via Flint Lake, to Hobert, and thence to Hammond, to connect with the Hammond, Whitney & East Chicago line.

TELEPHONE RIVALRY.—The White County Telephone Company, owners of all the toll lines leading into the city of Monticello, has declared war against C. M. Clark, owner of the local exchange. The telephone company uses the Bell instruments on all its lines, and the refusal of Clark to introduce Bell instruments precipitated the trouble. The company will establish another exchange in Monticello, and a cutting of rates is threatened.

THE LOGANSPORT TELEPHONE MUDDLE.—At the city council meeting at Logansport on Nov. 16, a special committee reported that a city telephone plant could be constructed at a cost of $40,000, and service could be provided for $1 at residences and $1.50 for business houses. The recommendations were made, and nothing will be done toward municipal ownership until a decision is reached regarding the Central Union proposition. The committee appointed to confer with the latter asked for further time.

AN ELECTRIC LINE TO WYANDOTTE CAVE.—Representatives of an eastern syndicate have examined the route from Corydon to Leavenworth, via Wyandotte Cave, and there is every indication that the road will be built. It would, besides affording easy transit to a cave of over 23 miles of excavation, or underground passage way, open up the most picturesque section in Indiana. The road will be 20 miles in length, and it is proposed to operate the electric plant by water power, as one of the water mills and dam along Blue river is included in the bonus offered by the farmers of the section through which the road is to run. The cave is reached at present only by stage.

CONTRACT AWARDED.—The last contract for the completion of the construction and equipment of the electric line from Greeenfield to Indianapolis was awarded on Nov. 16, as follows: For the overhead work, including poles and all line material, to the Chase Construction Company, of Detroit; the power house machinery, including a 1200-hp engine and two large dynamos, to the Arbuckle-Ryan Company, of Toledo; eight heavy cars, each of which will be fitted with four motors, of 35-hp, and with the Christensen air brake, to the Jewett Car Company, of Jewett, O.; the power house, to be completed in 30 days, and located at Philadelphia—half way point—to J. T. Pike & Co., of Knightstown. The grading of the road is near completion; tie and track laying was begun on Nov. 20. A 70-pound rail is being used, and all bridges are of steel. A double overhead trolley is provided for, two wires, six inches apart, being used, making a change unnecessary when taking a switch. The total amount involved in the contracts amount to over $400,000.

St. Louis, Mo., Nov. 25, 1899.

MEXICAN AGENCY.—The Holmes, Booth & Hayden Company has arranged in connection with Cable & Porteus, their St. Louis agents, for an agency in the City of Mexico.

THE UNITED STATES TELEPHONE MANUFACTURING COMPANY.—This firm, through Mr. Cable, the vice-president, is negotiating for a municipal plant of 1500-light alternators and 70 arc lights in Old Mexico.

THE ARIEL ELECTRIC & MANUFACTURING COMPANY filed articles of incorporation Nov. 20. The capital stock is given as $3000, all paid. The stockholders are Joseph N. Lanigan, Charles S. Broadhead and John Drier.

THE CHASE ELECTRIC SIGN COMPANY, of Illinois, filed articles of incorporation on Nov. 24. The capital is $10,000, of which $2000 is to be employed in the state of Missouri, with office and headquarters in the city of St. Louis.

FRANCHISE.—The St. Louis County Transit Company, recently incorporated at Jefferson by G. Phil Hoffman, John Hoffman and John H. Busch, have asked for a franchise from the county court. The capital is $50,000. The franchise is to be for a term of fifty years.

THE WESTERN ELECTRICAL SUPPLY COMPANY.—This company has arranged with a factory which it represents to manufacture for it a ceiling fan of neat design. This will place the company in a position to meet competition successfully during the coming season.

CABLE & PORTEUS.—This firm will ship for the St. Louis Electrical Supply Company a car load of weatherproof wire to Texas points. In this connection it is said that the demand by different jobbers for staple supplies has been so great lately that it is almost impossible to meet them.

THE AMERICAN WOVEN WIRE BRUSH COMPANY, of Peabody, Mass., has formed a St. Louis connection with Cable & Porteus as its agents for the Southwest. The company makes an excellent brush, and its circular matter is exceedingly attractive and is a great departure from the usual line of circulars.

OLD MEXICO BUSINESS.—There is a great deal of business being done by the electrical firms in St. Louis with Old Mexico. Three firms in particular are having all the business they can attend to in that section. The reason for this is the freight rates, which are such as to give St. Louis a decided advantage over other points.

FRANCHISE GRANTED.—The St. Louis, Clayton & Western Railway Company has been granted a 50-year franchise to operate an electric railway. The road is a cross country line about five miles long. The company promises to pay into the county treasury $200 after the first 20 years; $600 for the next 10, and $800 for the remaining time.

EDISON CLUB BANQUET.—The Missouri Edison Club, composed of members of the Missouri Edison and Wagner Electrical companies, met Nov. 23 at the Planters' Hotel. Before the meeting of the club a banquet was served. After the feast the following programme was carried out: H. A. Wagner discussed "Station Work and Recent Improvements in the Missouri Edison Company's Station;" "The New Bell Telephone Plant" was discussed by F. E. Bausch; "Views on Manila" was the subject of an address by F. S. Clark; "Economical Operation of an Electric Power Station" was considered by E. A. Cordes, and the evening's entertainment ended with an address by D. W. Roper on "Electrical Features of Overhead Wires." The stereopticon was used by all the speakers. P. J. Parket, president of the club, presided.

San Francisco, Cal., Nov. 20, 1899.

AN ELECTRIC RAILWAY LINE to connect Sumpter and Bourne, Oregon, is projected, with good prospects of its success.

ALUMINUM WIRE.—It is stated that the Telluride Electric Power Company has abandoned its scheme of using aluminum wire for carrying the electric current from its power plant in Provo Canyon to Mercur.

THE PORTLAND STREET RAILWAY COMPANY, Portland, Oregon, has been granted a franchise to build railway lines on Nineteenth Street and Sherlock Avenue as far north as Nicolai Street. There was a sharp competition for the franchise, and the city made very favorable terms with the company.

THE NEVADA COUNTY POWER COMPANY will soon have its power house connected with that of the Yuba Electric Power Company. The pole line, which is nearly completed, is eight miles in length. In case there is not sufficient power in Nevada County, Cal., the Yuba Company's current will be utilized.

THE OREGON TELEPHONE COMPANY'S Coas Bay line is completed, giving connection with Portland, via the long distance lines of the Sunset system. The new construction includes the connecting link from Roseburg to Myrtle Point. From the latter place new lines have been built to connect with the exchanges in the older towns of Coas County.

THE INDEPENDENT ELECTRIC LIGHT & POWER COMPANY, San Francisco, is now laying its conduits in the heart of the city. A large force of workmen is operating in Montgomery Street. Local electric stocks have been fluctuating. Competition and the provision of the new city charter, looking toward the installing of a municipal lighting system, may be responsible.

SOUTHERN NOTES.

Austin, Texas, Nov. 20, 1899.

STREET RAILWAY SOLD.—The West End street railway at San Antonio, Texas, was sold a few days ago at public auction. The purchaser was Mr. C. H. Beauchamp, of Dallas, Texas, and the consideration was $15,000. The new owner announces that he will make substantial improvements of the property.

THE DENISON & SHERMAN STREET RAILWAY COMPANY has purchased the street railway systems of Sherman and Denison. This company was organized with a capital of $275,000 and, in addition to operating the two systems above mentioned, it will immediately construct and operate a line connecting the two cities. Mr. J. P. Withers, one of the officers of the company, is now in Chicago placing orders for equipment, etc.

CANADIAN NOTES.

Ottawa, Ont., Nov. 25, 1899.

TO EXTEND WATER POWER PLANT.—It is expected that the Keewatin Power Company, of Norman, Ont., will proceed, next spring, to further develop its water power at that place.

TO REBUILD POWER HOUSE.—It is understood that the Niagara Falls Park & River Railway power house, which was burned a short time ago, is to be rebuilt, but, as yet, no contracts have been given out for the same.

MUNICIPAL ELECTRIC LIGHT PLANT.—The council for the city of Pembroke has decided to submit a by-law to the rate-payers to raise a loan of $30,000 for the purpose of installing a municipal electric light plant in the city.

MUNICIPAL PLANT FOR PRESCOTT.—At a recent meeting of the town council for the town of Prescott, Ont., it was decided to raise $15,000 by debentures for the installation of an electric lighting plant in that town under municipal control and ownership.

ELECTRIC POWER FOR THE SARNIA STREET RAILWAY.—At a meeting of the Sarnia Street Railway Company, of Sarnia, held a few days ago, it was decided to take steps immediately to convert the road into an electric system. Mr. J. Symington is president of the company.

MR. F. A. CHENEY, of St. Catherines, states that arrangements are completed for the extension of the railroad from that city to Port Dalhousie. An effort will be made to convert the existing 12 miles of the road into an electric line. It is expected that the passenger service will be run by electricity, but the freight business will be operated by steam until next spring.

DR. BRIGLAND, M. P. P., of Bracebridge, Ont., is a member of the board of directors appointed to take steps looking to the construction of an electric railway connecting the town of Bracebridge with Muskoka Lake. Mr. C. H. Mitchell, of Niagara Falls, has made a report to the council for the town of Bracebridge concerning the proposal to increase the power plant of the town for electric lighting purposes. The proposed improvements will give an increase of about 600-hp and will cost about $20,000.

THE MASSEY, HARRIS COMPANY has decided to equip its Toronto factory with a modern electric system for light, heat and power. It has contracted with the Canadian General Electric Company for 2-kw direct current generators, direct connected to Ideal engines. In conjunction with these the company is installing generator and feeder panels, arranged for controlling the system throughout all the different departments. This plant will be one of the largest isolated installation in the Dominion.

NEW INDUSTRY AT THE "SOO."—Another large manufacturing business is being established at Sault Ste. Marie, Ont., which promises to reach vast proportions in the near future. Mr. F. H. Clergue, president of the Lake Superior Power Company, has been instrumental in interesting American capital in the formation of the American Alkali Company, of which he is vice-president. The company proposes to manufacture caustic soda and other similar products under electrolytic processes, and the initial plant will require 1000-hp for its operation. There has been placed an order with the Canadian General Electric Company for three 300-hp specially designed generators to be direct connected to water wheels. The plant is expected to be in operation shortly.

NEW AUTOMOBILE COMPANY.—Another bicycle and automobile company has been formed to operate in Toronto. The new concern is an offshoot of the American Bicycle Company, and will be known as the National Cycle & Automobile Company, with a capital stock of $2,500,000. The new company will absorb the Stearns Bicycle Company, the E. & D. Bicycle Company, the Wheele Saddle Company and the Christie Saddle Company. The officers of the company will be: F. C. Evans, president; W. S. Evans, treasurer, and T. F. Byrne, secretary. The board of directors will be A. G. Spalding, New York; Col. A. A. Pope, Boston; A. L. Garford, New York; E. C. Stearns, Syracuse; T. P. Coffee, Toronto; A. R. Creelman, Toronto; Lemuel H. Foster, Detroit, and two or three prominent Canadians not yet decided on. The new company will build a large factory next year at a cost of $100,000.

NIAGARA POWER DEVELOPMENT IN CANADA.—Further important developments have occurred in connection with the schemes for the production of power on the Canadian side of Niagara Falls. Certain representations have been made to London capitalists in regard to the cost of works for developing power from the Chippewa River within Queen Victoria and Niagara Falls Park. These representations are now being inquired into, and if the estimates of cost were found to be as stated, the London syndicate will, it is stated, undertake the necessary works for the development of power. The scheme contemplates

the development of power at two points. The first development would be where the waters of the Chippewa flow over the big bluff in the park. Here it is thought 30,000-hp could be developed. Then by conducting the water in a canal through the park to a point below the falls, and utilizing the drop into the River Niagara, the power developed could be easily increased to 100,000-hp.

Quebec, Nov. 24, 1899.

MR. S. F. RITCHIE, of Aylmer, has purchased mining property near the town of Eardly, about 20 miles from Ottawa, and will install an electric power plant for working the mine.

MR. J. G. S. TRELAWNEY, of the Anglo-Canadian Syndicate, has applied to the Quebec government for a lease of a water power at Bryson, Que., with the object of developing the power for electric and other purposes.

ELECTRICAL CONTRACTS.—The Shawinigan Water & Power Company is about to let contracts for generators. The Shawinigan Carbide Company has completed its plans for the installation of an electric plant requiring 10,000-hp, and is now engaged in laying out the site for the same.

CALCIUM CARBIDE PLANT.—Enormous works for manufacturing calcium carbide are proposed for the mouth of the Shipsaw River, where it enters the Saguenay River. There is over 50,000-hp available, and the company proposing to operate is negotiating for it with the Quebec government.

AUTOMOBILES IN MONTREAL.—The automobile has made its first appearance on the streets of Montreal and created a favorable impression. Messrs. A. J. Corriveau and H. M. Dandurand have secured the Canadian rights, and they are now engaged in selecting a suitable site in or near the City of Montreal for the erection of an automobile factory, and the work of manufacturing the automobile will be commenced at once. It is stated that the vehicle can be put on the market for $600, a sum much less than what is now paid for this class of automobiles in American cities.

Halifax, N. S., Nov. 24, 1899.

NEWCASTLE, N. B.—The council for the town of Newcastle, New Brunswick, has invited tenders for the installation of an electric light plant in accordance with the plans drawn up by Mr. Duncan, the engineer in charge. The plant will be operated by water power.

THE DARTMOUTH ELECTRIC LIGHT COMPANY, of the City of Dartmouth, Nova Scotia, has placed an order with the Canadian General Electric Company for one of its standard 30-kw single phase alternators, with switchboard, transformers and the wiring complete.

THE NOVA SCOTIA ELECTRIC LIGHT COMPANY, of Halifax, N. S., which proposes to supply light and power on a somewhat extensive scale, has engaged an engineer to report on various water powers in that province. The company's options include the headwaters of the Gaspereau River and the Currell stream at Bridgetown.

ALTERNATING ENCLOSED ARC LAMPS.—Messrs. McMannus, Lane & McMannus, of Sydney, Cape Breton, have installed for the Nova Scotia Steel & Iron Company a complete electric lighting plant consisting of one 75-kw S. K. C. two-phase generator and a complete equipment of 60 alternating current enclosed arc lamps. This is said to be the first installation in Canada where an alternating current generator has its capacity entirely taken up with arc lamps alone, and speaks well for the future of alternating current arc lamps, and also of the progress being made along these lines. The plant was furnished by the Royal Electric Company of Montreal.

Vancouver, B. C., Nov. 20, 1899.

THE CARMAN TELEPHONE EXCHANGE COMPANY, of Carman, Manitoba, has been organized to build a telephone system in that town with outside connections.

NEW WESTMINSTER.—The corporation of New Westminster, B. C., has contracted with the Canadian General Electric Company for one of its standard 150-kw monocyclic generators, with switchboards, etc., for the supply of light and power throughout the city.

THE NELSON TRAMWAY COMPANY, of Nelson, B. C., has placed an order with the Canadian General Electric Company for its entire electrical equipment, including one standard 325-kw railway generator, one 500-hp, three-phase revolving field synchronous motor, together with a full complement of cars and motors. The Tramway Company has also contracted with the West Kootenay Power & Light Company, of Rossland, for the power necessary to operate the plant.

FOREIGN NOTES.

City of Mexico, Nov. 21, 1899.

MR. FERNANDO CORONA, a well known electrician of the City of Mexico, has contracted with a number of large hacienda, or farm, proprietors in the district of Zinapecuaro, in the state of Michoacan, to connect their homes with one another by telephone lines.

STREET RAILWAY FINED.—The secretary of communications of Mexico recently imposed a fine of $500 on the Federal District Street Railway Company, of the City of Mexico, as a penalty for irregularities in the street car service of the suburban lines of that company.

MILITARY TELEGRAPH IN MEXICO.—The secretary of war of Mexico recently ordered a number of young officers of the regular army of that country to practice military telegraphy in the field. After these officers have become proficient in that line of work they will be employed in the federal telegraph offices in the City of Mexico.

NEW MEXICAN TELEPHONE COMPANY.—A number of Mexican capitalists residing in the city of Guadalajara, Mexico, have organized a company for the purpose of establishing a new telephone system in that city. The company has been incorporated under the federal laws of Mexico under the title of the Compania Telefonica Jalisciense. The work of constructing its lines has already begun. The instruments and equipment were purchased in the United States.

ELECTRIC LIGHT IN ECCLESIASTICAL RESIDENCE.—Electric lights have just been installed in the elegant ecclesiastical residence of the archbishop of Mexico, in the City of Mexico. The archbishop recently returned from an extended visit to Rome, and is greatly pleased with the new electric light service in his establishment.

ELECTRIC RAILWAY IN TAMPICO.—Mr. Henry T. Levison, an electrical engineer, who has been investigating the needs for an electric railway in Tampico, Mexico, has organized a company with the view of establishing the desired improvement. He is now in the United States on business in behalf of the enterprise.

ELECTRIC LIGHT IN MAGDALENA, MEX.—An application has been made to the municipal authorities of Magdalena, state of Sonora, Mexico, by Alberto Azcona and Carlos Casanova for a concession to establish an electric light plant in that city. The concession will be granted and the work of installing the plant begun at an early date.

OPPOSITION STREET CARS IN MEXICO CITY.—A new street car line is being constructed from the heart of the City of Mexico to the fashionable suburb of Tacubaya by a company in opposition to the Federal District Street Railway Company. The new company has placed an order in the United States for 75 new cars to be used on its lines now under construction.

STREET RAILWAY IN OAXACA.—Thomas Welcher, an American electrician, has been in Oaxaca, Mexico, for the past several weeks making an investigation in behalf of a syndicate of Mexican capitalists in regard to the establishment of a new street railway system in that city. The city of Oaxaca is the southern terminus of the Mexican Southern railroad, and is thought to have a bright future.

General News.

THE TELEGRAPH AND TELEPHONE.

CINCINNATI, OHIO.—The Fitzsimmons Telephone Manufacturing Company has been organized here with a capital of $5000.

MANSFIELD, OHIO.—The People's Telephone Company, of this city, has completed toll line connections with Crestline, Galion and Bucyrus.

LAFAYETTE, TENN.—The telephone line from Lafayette to Willette, Tenn., is completed. The line from Lafayette to Westmoreland, Tenn., is also completed.

RICHMOND, VA.—The Wood Lawn Telephone Company, of Carroll, has been incorporated to construct and equip telephone lines from Hillsville, Va., to Oldtown, Va., and other towns.

JERSEYVILLE, ILL.—The Central Union Telephone Company, of Jerseyville, Ill., has built a new line between Jerseyville, Ill., and Hardin, Ill., with a new cable across the Illinois River.

NEWARK, N. J.—The New York & New Jersey Telephone Company has the control of the Newark Telephone Company, of Newark, N. J. The control of the stock, it is announced, was secured for $215,000.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company gave a mortgage to the Dime Savings Company for $3,500,000 for 20 years at 5 per cent. The money will be used in extending the telephone service.

BOSTON, MASS.—The Michigan Telephone Company has made a gain of 50 per cent. in its subscribers for the 10 months ended Oct. 31, and it is estimated that the company will gain 12,000 subscribers during the year.

WILMINGTON, DEL.—The Central Telephone & Telegraph Company has been incorporated; capital, $125,000. The principal office will be here, and W. D. Barnard and William C. Mayne, of Philadelphia, are among the incorporators.

HARTFORD, CONN.—The Waterbury Automatic Telephone Company has been incorporated; capital, $10,000. Incorporators, G. F. Hughes, M. J. Byrne, W. L. Hall, W D. Richardson, W. S. Jones, J. Blair, all of Waterbury; B. F. Mahon, of New London.

WATERVILLE, ME.—The Gray Telephone Company has been incorporated; capital, $300,000. Incorporators, H. W. Whitney, of Brookline; E. Gray, J. B. Millett, A. J. Mundy, all of Boston; H. M. Soule, of Newtonville, Mass.; C. W. Davis, of Waterville, Me.

ANNAPOLIS, MD.—The purchase of the Baltimore, Annapolis & Drum Point Telephone Company by the Chesapeake & Potomac Company, for $11,000, promises a great improvement in the telephone service of southern Maryland. It is proposed to run a line direct from Annapolis to Washington.

BOSTON, MASS.—The Clark Telephone & Telegraph Manufacturing Company has been organized here to manufacture and deal in telephone and telegraph apparatus; capital, $100,000. Incorporators, D. J. O'Connell, L. A. Frink, F. O. Emerson, J. M. Conlan, E. L. Tierney, all of Boston, Mass.

ROCHESTER, N. Y.—The Rochester Telephone Company has been incorporated with a capital of $400,000 to construct telephone lines from Rochester to Syracuse, Utica, Oswego, Watertown, Ogdensburg, Buffalo, Niagara Falls, Corning, Elmira and Binghamton. The directors are all Rochester men.

ROCKFORD, ILL.—The telephone war in this city, due to the application for a franchise for an independent company, has been settled by the offer of the Bell Company to the city council committee to reduce rates for business telephones from $42 to $36 a year and for residence instruments from $30 to $24.

WILMINGTON, DEL.—The Delmarvia Telephone Company, of this city, has formed an alliance with the Maryland Telephone Company, of Baltimore, Md., and an effort will be made to unite all the independent companies in this region, including the Diamond State Company, of Dover, into one organization.

BOSTON, MASS.—The New England Telephone & Telegraph Company is seeking rights for a new telephone line from Wareham and towns on Buzzards Bay direct to Boston. For years communication has been had with Boston only by a roundabout long distance service by way of New Bedford and Taunton.

MANCHESTER, N. H.—An application has been made in the Supreme Court to have the receivership of the Manchester Telephone Company vacated. The application is made by one of the New York stockholders, who claims that the receiver was appointed without the knowledge of a large majority of the stockholders.

MIDDLESBORO, KY.—The Virginia & Tennessee Telephone Company has began work on a through copper line, long-distance telephone from Roanoke to this city. The line will pass through Bristol, Tom's Creek, Big Stone Gap and other points. Connections will be made with Embreeville and Johnson City, and may extend to Marion, Va. The company is capitalized at $75,000.

PLAINFIELD, N. J.—The New York & New Jersey Telephone Company is making plans to extend its lines from Plainfield through North Plainfield township in Washington Valley, to intersect the line which now runs from Summit to Neshanic, and expects to have the line finished in the spring. Its purpose is to connect every town and hamlet within 40 miles of New York with New York.

NAPLES, N. Y.—The People's Telephone Company has been granted a franchise in this place for a local exchange, which will be installed during the present winter or early next spring. The company has 32 miles of metallic trunk line which connects seven towns and hamlets in Ontario County. It is now building a standard line fo four and six wires from Naples to Canadaigua, and will equip the toll lines with the Ericsson Swedish instruments.

CANANDAIGUA, N. Y.—The People's Telephone Company, of Ontario county, with a capital stock of $8000, has been incorporated. The lines of this company are intended to connect Naples with Canandaigua, Holcomb, Honeoye, Hemlock and intermediate points in Ontario county. The directors are Hector W. Blake, George R. Granby, Frank W. James, of Naples; John Ricketson, Bristol Springs; Mark A. Case, Bristol Center; Frank A. Jones, Holcomb; W. H. Doyle, Bristol.

ELECTRIC LIGHT AND POWER.

BIRDSBORO, PA.—A franchise has been granted to Mr. J. E. Sheriff for an electric plant of a capacity of 100 arcs and 1500 incandescents.

RIDGE FARM, ILL.—Ridge Farm Electric Light, Heat & Power Company has been incorporated; capital, $5000. Incorporators, W. M. Bedinger, E. A. Little, C. T. Lourig, all of Ridge Farm.

BLISSFIELD, MICH.—The Blissfield Electric Power Company has been incorporated; capital, $10,000. Incorporators, W. Schroder, Caroline P. Schroder, C. F. Seeger, J. E. Forsyth, J. Baily, all of Blissfield.

NEW YORK, N. Y.—The American Power Transmission Company has been incorporated; capital, $500,000. Incorporators, S. A. Bennett, A. S. Fisher, T. N. Riprom, L. R. Mestaniz, E. F. Perry, all of New York City.

ST. HELENA, CAL.—St. Helena Pure Water, Electric Light & Power Company has been incorporated; capital, $125,000. Incorporators, F. Beringer, W. W. Lyman, C. Caspey, G. W. Schmidt, all of St. Helena; E. D. Cooley, of one now in use.

VERGENNES, VT.—The Vergennes Electric Company has bought of the Warren Electric Company, of Sandusky, Ohio, a 75-kw alternating generator of the latest type. This machine will have more than double the capacity of the of the one now in use.

ST. LOUIS, MICH.—The City Council has purchased the plant of the St. Louis Electric Light Company for $7500 and will take immediate possession. This ends a fight between the city and the electric light company which has been in progress for nearly two years.

FORT WORTH, TEX.—One of the big engines in the power house of the Standard Light & Power Company was wrecked recently. A bolt on one of the side rods broke and the machinery thrashed itself to pieces. No one was hurt. The loss was between $1200 and $1500.

NAPLES, N. Y.—There is no electric lighting in this village, but the conditions are favorable for such an enterprise. There is a fine water power within two-thirds of a mile of Main Street, which is not used at all for any purpose whatever. The village has a population of 1200.

CONCORD, N. H.—The Newmarket Electric Light, Heat & Power Company has been incorporated with $1000 capital. Incorporators, Joseph Pinkham, Charles E. Tasker, Alanson C. Haines, Charles A. Morse, Charles W. Rogers, all of Newmarket, and Arioch W. Griffiths and James W. Burnham, of Durham.

OAKLAND, ME.—The annnal meeting of the Oakland Electric Light Company was held recently. An offer for the purchase of the whole plant had been made and the election of officers was therefore deferred. Mr. Walter S. Wyman and Harvey D. Eaton, both of Waterville and the prospective purchasers, were both present to make their statements, and it was voted to make the sale.

DEADWOOD, S. D.—Fifteen miles of water rights on Spearfish Creek have been purchased from William Lardner, of Deadwood, by the Cascade Water Power & Electrical Transmission Company, which proposes to put in a 15,000-hp electrical plant to furnish electric power and light to the mines and cities of the Black Hills. The consideration paid for the water right was $100,000.

SHAMOKIN, PA.—The Shamokin Light, Heat & Power Company has been formed by a consolidation of the Edison Electric Illuminating Company, the Shamokin Gas Light Company and the Shamokin Electric Light & Power Company. The capital of the company is $250,000, and there will be an issue of $250,000 of 5 per cent. thirty-year gold bonds, redeemable at any dividend period after ten years at 110. The stockholders are principally from this place and York.

THE ELECTRIC RAILWAY.

CLEVELAND, OHIO.—The Little Consolidated is making an effort to secure an immediate extension of all its franchises for 25 years.

WILMINGTON, DEL.—The Wilmington City Railway Company is making a survey for a line to run from this city to Newport, and thence to Marshalltown.

AMERICUS, GA.—It is stated that a company will be formed here to construct another street railway system in this place to be operated by electric power.

CORSICANA, TEXAS.—A liberal franchise is offered by the Corsicana Commercial Club to anyone who will construct a first class street railway system in this city.

NORFOLK, VA.—The Virginia Electric Company, Norfolk Street Railway Company and the Ocean View Railway Company have been consolidated. The combination represents an actual capital of $1,950,000.

PINE BLUFF, ARK.—The city council of Pine Bluff has granted to Matthew Roberts, of Kansas City, a 50-year franchise for an electric street railway. The road is to be completed within 12 months or the franchise forfeited.

SCRANTON, PA.—The Wilkesbarre & Wyoming Valley Traction Company has completed arrangements with the Scranton Traction Company by which its cars will be run direct from Wilkesbarre to Scranton. The connection between both roads is being built, and it is expected to be completed by Christmas.

BRAINTREE, MASS.—The New York, New Haven & Hartford Railroad Company has decided to continue the operation of the South Shore branch as far as Cohasset by the third rail system of electricity during the coming winter. The step will be taken chiefly as an experiment, to show the working of the system under winter conditions.

PORT HURON, MICH.—All of the right of way necessary to complete the electric road from Marine City to Port Huron has now been obtained and cars are expected to be run over it early during the coming year. The completion of this line will make it the longest electric road in the country, making a through line from Detroit to this city.

ALBANY, N. Y.—The street railway companies in Albany and Troy will be consolidated under the name of the United Traction Company. This action, it is stated, is the forerunner of a consolidation of trolley roads which gives a continuous line from Albany to Lake George via Mechanicville, Stillwater, Schuylerville, Saratoga, Fort Edward, Glens Falls and Caldwell.

WILMINGTON, DEL.—The project to build a trolley railway from Wilmington to West Chester, Pa., via the Wilmington and Great Valley turnpike, the most direct route, has assumed definite shape. A committee was appointed to look after the matter of getting the right of way and ascertaining what arrangements can be made for terminal facilities in Wilmington and West Chester.

DETROIT, MICH.—The projected improvements to the Bay Cities Consolidated Street Railway Company will be carried to completion as speedily as possible. The improvements will cost from $150,000 to $200,000, and include, among other things, a new power house, new viaduct over the Michigan Central Railroad tracks in West Bay City, and the rebuilding of the west side system with T-rails.

NEW YORK, N. Y.—Property owners at Classon's Point, Bronx Borough, have served notice on the Union Trolley Railway Company of the withdrawal of consents for building a trolley line in Westchester Avenue to Classon's Point. As the trolley company has taken no action, the property owners will open a line of automobiles of new pattern from Classon's Point to the nearest Third Avenue "L" station.

ATHOL, MASS.—New York investors who are interested in the construction of a nearly completed electric road between Gardner and Templeton are considering the question of building a line between Templeton and Athol and have asked for estimates on material. This line would be nine miles long and would connect Baldwinville and Royalston, which are situated several miles off the direct route, by means of spur tracks.

DETROIT, MICH.—A number of Detroit capitalists have organized a company and will construct an electric railway between Detroit and Toledo that will be in operation next summer. The road will be as nearly an air line as the topography of the route will permit. The distance is 55 miles. The officers are: President, C. A. Black; vice-president, E. M. Fowler; secretary, A. E. F. White; treasurer and general manager, J. M. Mulkey.

BOSTON, MASS.—The railroad commissioners have approved the consolidation of the West Roxbury & Roslindale Street Railway, the Norfolk Central, Norfolk Suburban and the Needham & Boston Street Railways, to be known as the West Roxbury & Roslindale Street Railway. The board also authorizes the West Roxbury & Roslindale Street Railway to issue $337,500 additional stock for the exchange of shares of the several companies on a share for share basis.

ALLENTOWN, PA.—All the street railway companies, nine in all, operating in and around Allentown, have been merged into one concern, to be known as the Lehigh Valley Traction Company. The capital stock of the company is $3,000,000, and the bonded debt $3,000,000, at 4 per cent. The following officers were elected: President, A. L. Johnson; vice-president, Tom L. Johnson; secretary, J. E. Kenny; directors, A. L. and T. L. Johnson, Samuel Harris, Robert E. Wright and W. J. Hartzell.

DETROIT, MICH.—It is stated that a plan is on foot for the purchase of the Saginaw, Tuscola & Huron Railroad, running from Saginaw to Bad Axe, by a company in which the Saginaw Valley Traction Company is interested, and that if the deal is consummated the road will be equipped for electricity. The Saginaw Valley Traction Company now owns local and interurban lines to Bay City, and is desirous of obtaining control of Bay City lines. It is also said to be anxious to get extensive lines through the "Thumb" and Saginaw Valley.

ALBANY, N. Y.—The Delaware Valley & Kingston Railway Company, with a capital of $2,500,000, has been incorporated. It will be operated by electricity

and be about 81 miles in length, with termini at Kingston and at a point in Sullivan County, on the boundary line between New York and Pennsylvania. The railroad will run through Ulster, Orange and Sullivan counties. The directors are Samual D. Coykendall, Kingston; Edward L. Fuller, Scranton, Pa.; Walter Ferguson, Stamford, Conn.; James N. Jarvis, Frederic P. Olcott, John W. Sterling, Samuel Thorne, William V. S. Thorne and George G. Williams, of New York City.

FALL RIVER, MASS.—The aldermen have granted a franchise in about 20 miles of the city's streets to the Fall River Long Shore Railway Company. The road is to be completed in 18 months after the grant is approved by the road commissioners. Among the conditions are 5-cent fares, six tickets for 25 cents, seven tickets for 25 cents during the hours of 5:30 and 7:30 morning and evening; if, after 1906, the company shall have paid 8 per cent. or over on its capital stock, the road shall water such streets as may be required by the board of aldermen; if, in 1915, or after the purchase is so legalized, the city may acquire the property at a fair market value.

PORT HURON, MICH.—The preliminary papers for the locating and construction of the proposed new electric railway company from here to Bay City have been executed, and the work of surveying will be commenced at once. Ex-Mayor N. S. Boynton, of this city, who has interested himself in the matter, says that the parties back of the project are entirely responsible and if after a thorough inspection of the route the conditions are found to be as shown by the preliminary investigation the road will be an assured fact. It is also to be built without demanding any local aid in the shape of bonuses whatever, the right of way being all that is to be asked for.

MARLBORO, MASS.—Negotiations have been completed whereby the control of the Marlboro Street Railway, including the Hudson Line, Marlboro, Southboro & Framingham road and Union Street Railway, which connects Framingham, South Framingham and Saxonville, passed to the Boston & Worcester Electric Street Railway Company, which is now securing franchises in towns and cities between Boston and Worcester for its proposed road, which is scheduled to pass along the old Worcester turnpike, and which will in reality be an express electric line between the cities. The securing of the control of the roads in question is said to be the second largest electric street railway deal in New England, and as a result there are in contemplation radical improvements in the service on lines secured. The absorption of another line, which will open a direct line of electric railway from Fitchburg to Boston, is expected.

THE AUTOMOBILE.

UNITED STATES AUTOMOTOR COMPANY has been incorporated in Jersey City to manufacture automobiles. Capital, $1,000,000. Incorporators: Charles O. Troll, Louis J. Frey, Frederick W. Hotchkiss.

THE MESSERER AUTOMOBILE COMPANY has been incorporated at Newark, N. J It will manufacture automobiles. The capital stock is $300,000. Incorporators. Stephen Messerer, Joseph Fisch, Julius E. Seitz and Adolph Goldfinger, all of Newark.

THE SPARKS AUTOMOBILE COMPANY has been incorporated in California, with a capital of $1,000,000, and will erect a large plant near San Francisco. One peculiar feature of the vehicles it will make is that the power will be applied to all the wheels.

THE HOWARD AUTOMOBILE COMPANY has been incorporated at Trenton to manufacture automobiles on patents secured by William L. Howard. Frank W. Muschert, Frank H. Williams, George B. Yard and William Howard, of Trenton, incorporators. Capital, $200,000.

POST AUTOMOBILE.—It is stated that the National Light & Power Company, of Philadelphia, intends to run automobiles in the streets of New York in opposition to the Electric Vehicle Company's cabs. The National Company controls the patents on the Post storage battery. The battery is so light that each vehicle can carry sufficient power to propel it 100 miles without recharging. The New York directors of the new company are: Frank R. Walton, Edward L. Fuller, Edward S. Savage and Milo M. Belding.

PERSONAL.

MR. FRED W. C. BAILEY, electrical engineer, of Columbus, Ohio, has been a visitor in New York City this week renewing acquaintances. He was at one time on the engineering staff of the Edison General Company and has since been engaged in a variety of engineering work in his own section of the country.

MR. ROBERT W. BLACKWELL, head of the firm bearing his name in England, arrived on a trip last week to follow up some important matters needing personal attention on this side of the water, where there are several large concerns which he represents in Europe. He states that the demand for American material and apparatus continues active.

MR. J. E. WALKER, who, for the past four years, has been in charge of the credit and collection department of THE ELECTRICAL WORLD and THE ELECTRICAL WORLD AND ENGINEER, severs his connection Nov. 30, to become associated with Wm. Roche, the manufacturer of the "New Standard" dry battery. Mr. Roche is to be congratulated on securing the services of such a valuable man. Mr. Walker's large circle of friends and acquaintances in the trade, as well as his old associates, wish him every success.

MR. U. N. BETHELL, general manager, and Mr. H. L. Webb, expert, etc., of the New York Telephone Company, have just returned home from a prolonged European trip, made with a view of examining telephonic methods there, and, if possible, of benefitting from them. The range of travel, Mr. Bethell states, extended from Stockholm, in the northeast, to Buda Pest in the southwest, and they were everywhere received with great kindness and courtesy. Mr. Webb made an even more prolonged investigation over the same ground in 1894-5.

MR. W. J. JOHNSTON arrived at Pekin Nov. 11, after a visit of about 10 days to Seoul, Corea, and vicinity. The next stages of his journey will be Shanghai and Amoy, at which latter place he expected to arrive Nov. 24, and thence proceed to Formosa, in order to join a party to the interior. At present the relations between the Japanese and the Formosan tribes are those of bitter warfare, but the enmity of the latter does not extend to English and Americans. As an evidence of this good feeling the chiefs of some of the head-hunting tribes have asked a party of white foreigners to visit them in their fastness, which party Mr. Johnston has been invited to join.

OBITUARY.

R. J. HUTCHINSON, a well known telegrapher of New York City, died of heart disease on Friday last, at his home in New York, at the age of 50 years. He was superintendent of telegraph in the New York Stock Exchange, and also president of the Gold & Stock Life Insurance Company, and of the Magnetic Club. Mr. Hutchinson was born in Ireland.

EDUCATIONAL.

ELECTRICAL ENGINEERING AT THE UNIVERSITY OF ILLINOIS.—Several new courses in the Department of Electrical Engineering were offered by this institution at the beginning of the present college year. The degree of bachelor of science in electrical engineering is given on the successful completion of any one of these courses. For the professional degree of electrical engineer five years' work must be satisfactorily completed. The equipment of the electrical engineering laboratory is being continuously increased, both for regular and for advanced work in these and in the allied branches of laboratory instruction.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY through members of its faculty is intimately connected with what in other cities would be called university extension, but is known in Boston as the "Lowell Free Courses." These members of the faculty give, in the Lowell Free Courses, lectures on such general or professional subjects as are chosen each year for the series. The treatment is adapted in some cases to the needs of teachers and advanced students, in others to the wants of men engaged in technical pursuits who may have been unable to obtain a comprehensive scientific or literary education. Courses are offered in literature and language, as well as in science and engineering. Lectures on steam engineering (from the generation of steam to its use), practical methods of testing steam plants, and discussions on economical practices have been held two evenings every week. Another course deals with descriptive geometry and in another demonstrations on the use of electrical measuring instruments are attended by a class.

Trade and Industrial Notes.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has issued a Thanksgiving proclamation to electricians asking them to be thankful for Eaco tape.

THE FEDERAL BATTERY COMPANY, of New York, reports a shipment of Federal battery salts to The Oceanic Gas & Electric Company, who is its agent in Honolulu, H. I.

MR. A. B. LAURENCE, manager of the Shultz Belting Company, New York, has just received a contract from the Chelsea Jute Mills, Brooklyn, for two 34-inch and two 32-inch Shultz Sable rawhide belts.

THE STEAM LOOP.—Messrs. Westinghouse, Church, Kerr & Co., New York, have just issued a circular describing and illustrating the steam loop and Holly gravity return system. All interested in the generation and use of steam should familiarize themselves with this apparatus.

THE PERU ELECTRIC MANUFACTURING COMPANY, Peru, Ind., is placing on the market a new style Creole rosette, which the company has named the "Peruco." This rosette is said to have many advantages over the old style, and it is predicted that it will become popular with electricians.

METALLIC ROD PACKING.—The Reeves Machine Company, Trenton, N. J., manufactures Harthan's metallic rod packing for piston rods and valve stems, and describes and illustrates the same in a little pamphlet just issued. All interested in steam engines are invited to investigate the merits of this packing.

FLY WHEEL ACCIDENTS.—A safety device has been placed on the market by the Lincoln Electric Company, Cleveland, Ohio, for the prevention of the condition which frequently leads to the bursting of fly wheels. By means of the device a dynamo is cut off from a line to which it is connected whenever it tends to act as a motor.

CHAPMAN VOLTAGE REGULATORS.—Mr. A. W. Koenig, 9 Maiden Lane, New York, representative of the Belknap Motor Company, of Portland, Me., has just sold two Chapman voltage regulators, one to be installed in the station of the Suburban Electric Company, Elizabeth, N. J., and the other in the station of the Poughkeepsie Electric Light & Power Company, Poughkeepsie, N. Y.

HEAT INSULATION.—The American Insulating Material Manufacturing Company, St. Louis, Mo., has issued a catalogue explaining the advantages of its granite rock wool sectional pipe and boiler coverings for high and low pressure. The method of applying the covering is illustrated. The catalogue contains fac-similes of testimonial letters from different concerns using this insulation and all speak highly of it.

STERLING INSULATING VARNISH.—The Sterling Varnish Company, Pittsburg, Pa., has issued a booklet on the subject of insulating varnish. This booklet has 84 pages largely devoted to facsimile of letters of recommenda-

tion, etc. The Sterling Varnish Company intends to distribute it among the manufacturers and users of electrical apparatus and has printed an edition in French and German for distribution on the continent.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, in its Circular No. 55, gives a reprint of an article contained in the railway number of *Cassier's Magazine* on "Storage Batteries and Electric Railways," written by Mr. Herbert Lloyd. The article is accompanied by various illustrations of railway storage battery plants and apparatus, together with curves illustrating the advantages that may be derived by the use of storage batteries in connection with the operation of an electric railway.

PREHISTORIC IMPLEMENTS.—Warren K. Moorehead, of Saranac Lake, Franklin County, N. Y., has issued a very interesting book on prehistoric implements, covering all the known types of ornaments, implements, weapons, utensils, etc., of the native tribes of the United States and Canada. The work has not been issued for profit, but to supply a demand which inquiries of Mr. Moorehead has shown to exist. The work is published by subscription, the price being $2 and contains between 400 and 500 pages.

THE MUNSON COMPANY, La Porte, Ind., is engaged in perfecting an automobile, using as its motive power a combination of electricity and gasoline, an invention patented by Mr. John H. Munson. Mr. W. H. Phelps, a gasoline expert and mechanical engineer, has recently become associated with the Munson Company. The company expects to have an odorless and practically noiseless wagon ready early in December. It will then be prepared to take orders for automobiles for any service.

W. S. HUTTON, in his "Steam Boiler Construction," states that "the economy that may be obtained by combustion with forced draft in a steam boiler is due to the increased rate of combustion and increased efficiency of the heating surfaces produced by it, resulting in increased boiler power. The increase of power obtained depends principally upon the quantity of air brought into intimate contact with the fuel in a given time, but the power of the boiler may generally be increased from 40 to 100 per cent. by the application of well arranged forced draft."

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, reports that its trade in line and central station supplies has been especially gratifying. The demand for the Moloney transformers and A. B. enclosed arc lamps has grown so rapidly that the company states that it can hardly take care of the orders. In the Moloney transformer the company claims to have a transformer whose copper and core losses are reduced to a minimum, of extremely close regulation and high efficiency. It is willing to guarantee these transformers for two years.

INCANDESCENT LAMP HANGER.—Mr. M. I. Vought, LaCrosse, Wis., manufacturer and dealer in electrical specialties, reports an active demand for his adjustable incandescent lamp hanger. Besides being a neat device, it permits of the light being applied wherever it is needed. It sustains any shade in common use and is free from springs and mechanism, which are liable to break and get out of order. These hangers are finished to harmonize with the surroundings, whether in the parlor, the office or the workshop. They are simple, practical, durable and convenient.

MESSRS. E. B. LATHAM & CO., 136 Liberty Street, New York, have just issued a lot of trade literature. A pamphlet is devoted to sockets and receptacles for lamps with Edison screw bases. Dale's desk light is briefly described and illustrated in a folder, and the Kinsman portable is also treated in a similar manner. Another circular tells all about the Newgard combined waterproof receptacle and globe. The use of this receptacle and globe insures a permanency of wiring in wet places, such as are met with in breweries, packing houses and in establishments where it is customary to wash the floors, walls and ceilings. It is also adapted for outdoor use, especially on steamers and work under water for scenic effects, where it can be used with perfect safety.

THE OHIO ELECTRIC WORKS, Cleveland, Ohio, is keeping abreast of the times and is exerting itself to secure foreign trade. Its sheet of wholesale prices and discounts is printed in the Spanish language as well as English. The company is offering extraordinary inducements to agents, and in a recent circular of information gives a brief account of many of the specialties made by it. The list of its products is a long one, but a few of them may be mentioned, viz.: Battery fan motors, bicycle lamps, electric scarfpins, medical batteries, cigar lighters, student electric lamps, table lamps, etc., etc. The company also makes marine and stationary gas and gasoline engines, which are recommended for their simplicity, durability and strength. They are giving satisfaction to users.

DRY BATTERIES IN THE SIGNAL SERVICE.—It requires no argument to demonstrate the advantages of dry batteries for military signaling service, or for other work in the field requiring electric current. The "O. K." dry battery, manufactured by the Non-Polarizing Dry Battery Company, 625 Broadway, New York, has made a name for itself in the army, and is evidently highly thought of judging from a letter to the company from Eugene O. Fechet, captain and signal officer U. S. volunteers, with headquarters at Washington. Captain Fechet states that the "O. K." dry cells have proved to be exactly as represented, and that they have been adopted as the standard dry cell of the service. This "O. K." battery was, he says, the only make of dry cells used in Cuba and Puerto Rico, and they are now used in the Philippines. They last "longer than any other make we have ever used," Captain Fechet writes in conclusion.

THE HAZARD MANUFACTURING COMPANY, of Wilkesbarre, Pa., has just issued a 46-page pamphlet on the subject of bare and insulated copper wires and cables manufactured by this concern. The company has recently extended its works, established since 1848 for the manufacture of steel, iron and galvanized iron rope, to include the manufacture of insulated electric conductors. This new department is equipped with the most modern and improved facilities for the production of insulated wires and cables of the highest grade. The range of manufacture covers not only weatherproof, fibre and rubber insulation in the standard sizes of wires and cables, but also such special requirements as the best electrical engineering practice suggests. All the copper wires are drawn in the company's own wire mill. The insulation consists of compounds composed of the highest grades of Para rubber and other necessary preservative ingredients. They have been carefully tested as to their resistance to destructive influences, and have been found, it is stated, to be equal, if not superior, to any now in use. The weatherproof insulation adopted by this company is not readily affected by extremes of temperature and is thoroughly water and weatherproof. All wires and cables are tested with an alternating current in addition to galvanometer tests before leaving the factory. The manufactures cover every department of electrical work, including telegraph, telephone, electric light, power, railway, etc. The catalogue contains a great deal of valuable information regarding wires, cables, etc., all of which will be very valuable for reference.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED NOV. 21, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

637,232. AUTOMATIC FIRE EXTINGUISHER; J. Butcher, Jersey City, N. J. App. filed Jan. 12, 1899. A thermostat closes an electric circuit through a motor which opens the cock in the water service pipe and allows the water to flow to the various discharging points or nozzles. At the same time a circuit is closed through an electromagnet which opens a valve at the nozzles and allows the water to flow.

637,246. SNAP SWITCH; M. Guett, Hartford, Conn. App. filed Aug. 16, 1899. Details of construction.

637,282. ELECTRIC INSULATOR; J. A. Poche, New Orleans, La. App. filed April 17, 1899. This insulator is to be inserted in a partition to act as a bushing for the wire. The ends of the bushing are plugged up to be both air and water-tight.

637,290. TELEGRAPH INSTRUMENT KEY; C. J. Scheffler and C. V. Walls, New Castle, Pa. App. filed Jan. 7, 1899. This is a self-closing key, the invention consisting in attaching to an ordinary key a specially constructed spring-actuated lever for automatically closing the circuit when the key is not in use.

637,318. BURGLAR ALARM FOR WINDOWS; R. Baumann, St. Louis, Mo. App. filed Nov. 7, 1898. The invention lies in a peculiar construction of circuit closer to be operated by the sash.

637,321. ELECTRIC MASSAGE INSTRUMENT; L. Casper, Chicago, Ill. App. filed May 23, 1899. The instrument includes rollers and hammers which act upon the skin at the same time that the terminals of the circuit make contact therewith.

637,323. ELECTRIC SWITCHBOARD; C. H. Cox, Liverpool, England. App. filed April 29, 1899. The switchboard is made of a skeleton framework of iron tubes and boxes, the tubes and boxes being connected together. Within the boxes are placed the various appliances, such as switches and fuses, and within the tubes are placed the cables, bars and other electrical leads from one appliance to another.

637,337. RAILWAY SIGNALING APPARATUS; W. Hume, London, England. App. filed Oct. 6, 1898. With this apparatus the persons in charge of a moving train may be signaled from a station. Circuits are run from the station to certain points where the train is to receive its information and there the roadbed is equipped with fixed terminals, with which a device on the train makes contact.

637,377. MEANS FOR PREVENTING TAMPERING WITH FIRE ALARM BOXES; F. Ely, Newark, N. J. App. filed March 17, 1899. The alarm box is placed in a cage and an alarm cannot be sent in unless a person enters the cage and closes the door behind him. After the alarm is sent some other person with a proper key must release the person in the cage.

637,349. ALTERNATING CURRENT ELECTRIC MOTOR; C. L. Rosenqvist, Birmingham, England. App. filed March 31, 1898. (See Current News and Notes.)

637,409. ELECTRIC PROTECTOR FOR BUILDINGS; J. A. Poche, New Orleans, La. App. filed April 21, 1899. This is an automatic cut-out arranged to sever the connection between the service mains and the wiring of the building.

637,414. ELECTRIC SIGNALING APPARATUS FOR RAIL OR TRAMWAYS; F. W. Prokov, Berlin, Germany. App. filed Dec. 30, 1899. The motor of the signaling mechanism is released either automatically by a train or manually from a station, by suitable devices, the construction of which constitutes the invention.

637,422. GALVANIC BATTERY; C. B. Schoenmehl, Waterbury, Conn. App. filed March 2, 1899. (See Current News and Notes.)

637,448. ELECTRIC ARC LAMP; W. J. Davy and G. Thomas-Davies, London, England. App. filed Oct. 7, 1897. The idea is to obtain a perfect enclosure without the aid of the outer globe, and dispensing with the use of a sliding joint through which air or gas can pass.

637,453. TELEPHONE TRANSMITTER; E. F. Frost, U. S. Army. App. filed Aug. 19, 1899. (See Current News and Notes.)

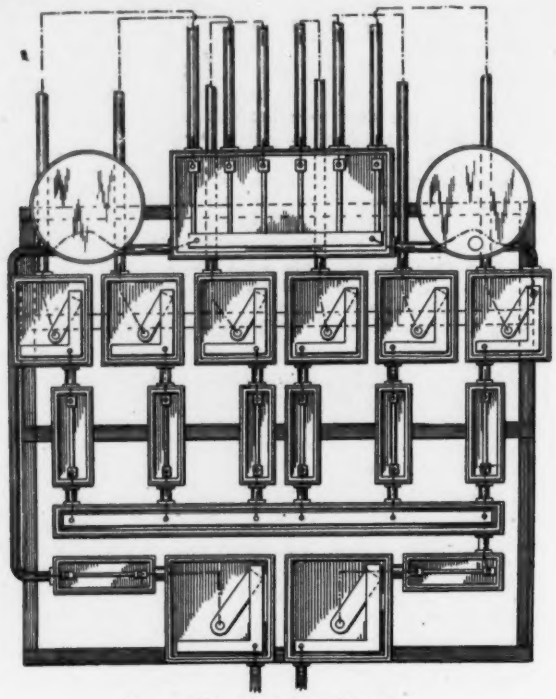
637,454. ELECTRIC CLOCK; F. I. Getty, Chicago, Ill. App. filed Sept. 26, 1898. Weights at the end of levers act upon the clock train through pulley and ratchet connection. After a certain movement of the weight the cir-

cuit of a magnet is closed and the weight is lifted, these operations being continued at intervals.

637,457. ELECTRIC HOUSE WIRING; C. T. Greenfield, New York. App. filed March 29, 1899. The invention consists of a flexible armored tubing for the wires, which is self-compensating for variations of heat and cold. This is held in place by permanent fixtures in the wall which will not be disturbed or moved, as is usual, by variations in temperature after the conductors have been put in place.

637,473. MOTOR WATTMETER FOR THREE-PHASE ALTERNATING CURRENTS; J. A. Mollinger, Nuremberg, Germany. App. filed Aug. 31, 1898. (See Current News and Notes.)

637,474. CIRCUIT BREAKER; D. L. Moore, Jr., Philadelphia, Pa. App. filed March 18, 1899. This is a time circuit closer, the invention residing in the details of construction.



637,323.—Electrical Switchboard.

637,538. ANTISEPTIC DEVICE FOR SOUND-TRANSMITTER MOUTHPIECES; G. W. Van Alstine, Los Angeles, Cal. App. filed Aug. 3, 1899. (See Current News and Notes.)

637,625. APPARATUS FOR FORMING PLATES FOR SECONDARY BATTERIES; H. Leitner, London, England. App. filed June 12, 1899. (See Current News and Notes.)

637,635. MANTLE FOR ELECTRIC ARC LAMPS; P. Mersch, Paris, France. App. filed Dec. 27, 1898. This is a sleeve composed of clay, alumina and kaolin, which is passed around or near to, the arc to become incandescent.

637,678. EXPLOSIVE SIGNALING APPARATUS FOR RAILWAYS; W. R. Sykes, London, Eng. App. filed Sept. 13, 1899. This is a device for automatically putting a cartridge into condition to be fired by a train passing over it, when the regular visual signal is set.

637,711. DRIVING MECHANISM FOR DYNAMOS; J. L. Creveling, New York, N. Y. App. filed Sept. 10, 1898. (See Current News and Notes.)

637,739. APPARATUS FOR HAULING OR DRAWING CABLES; C. H. Matchet, New York. App. filed Aug. 21, 1899. Comprises a suitable frame having an annular passage through which the cable to be operated upon, passes, and radially movable blocks adapted to be moved inwardly to clamp the cable between them.

GERMAN PATENTS, ISSUED NOV. 8, 1899.

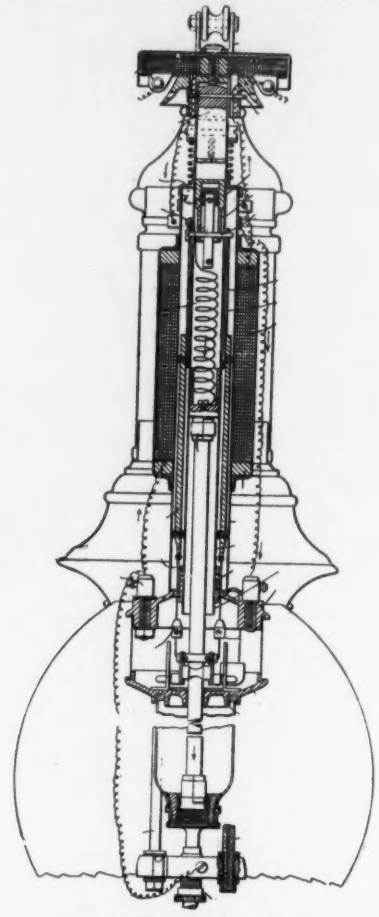
[In Charge of Dr. Ralph Julian Sachers, 120 Liberty Street, New York.]

104,778. DIRECT CURRENT TRANSFORMER; A. Wydts and G. Weissman, Paris. App. filed Aug. 10, 1898. Two primary coils consisting of an equal number of sections of the same number of windings have conducting wires leading from each section to the bars of a commutator. These bars are connected in pairs in such a way that by turning a brush, which connects two diametrically opposite bars, both coils may be arranged in the same or opposite direction, without interrupting the current or changing the current strength or the number of sections through which the current passes. In the cores of the coils there is thereby created a continuously changing field which produces alternating current in suitable secondary coils. This alternating current may be transformed into direct current by a suitable commutator running synchronous with the above mentioned brush.

105,002. TELEPHONE TRANSMITTER; August Emil Sebastian Anderson and August Hermann Skoeld, Stockholm. App. filed Nov. 21, 1897. The granular carbon contacts are arranged in series by means of insulating material, so that one of the same is located centrally to the diaphragm and the other in circles concentric to the first. The transmitter may thereby be of the smallest possible form without impairing distinct articulation at long distance and without an induction coil.

105,055. METHOD OF PRODUCING ACTIVE MATERIAL FOR STORAGE CELLS; C. H. Boehringer Sohn, Nieder Ingelheim. App. filed July 15, 1898. (Addition to patent No. 95,903 of June 4, 1896.) Instead of using syrup-like lactate of lead as claimed in the original patent, there is now employed purified crystallized lactate of lead.

105,056. METHOD OF PRODUCING ACTIVE MATERIAL FOR STORAGE CELLS; C. H. Boehringer Sohn, Nieder Ingelheim. App. filed July 15, 1898. (Second addition to patent No. 95,903, of June 4, 1896, and first addition No. 105,055 of even date.) Instead of using the

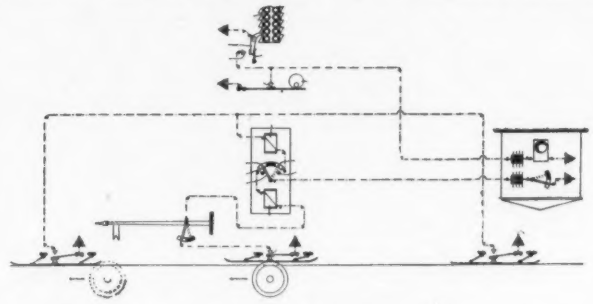


637,448.—Electric Arc Lamp.

lactate of lead $(C_2H_5O_2)_2$ Pb, there is now one employed $C_2H_4O_2$ Pb. This, in connection with oxides of lead, produces in the presence of water a paste which remains plastic for some time and hardens to a strong ringing substance.

105,089. COMMUTATOR FOR DYNAMOS; James Burke, Berlin. App. filed Dec. 2, 1898. The commutator is formed of bars of angular cross-section. The protruding of a single segment at the periphery of the commutator is prevented by the mutually interlocking of the segments.

104,726. STARTING DEVICE FOR ELECTRIC ELEVATORS; Schuckert & Co., Nuernberg. App. filed Dec. 17, 1898. A contact piece is provided on every floor in an elevator shaft and is connected by wire to another contact piece of a switch in an engine room. As soon as the elevator moves up or down, and reaches one of the floors, the circuit is closed between the several contacts, and a resistance is thrown in which produces a decrease in the speed of the motor.



637,678.—Explosive Signaling Apparatus for Railways.

104,949. ELECTRIC ELEVATOR; Gustav August Kuenstler, Unterweissenbach, Ober Oesterreich. App. filed April 5, 1898. The elevator car will stop automatically at any predetermined place. To accomplish this two conductors are provided along the total length of the elevator shaft. One of the conductors is made of one piece, whereas the other is in sections. Each of the sections is connected to a switchboard, and if this switch is adjusted so as to cut out one of the sections, the car, of course, will stop at that place.

104,564. ELECTRIC SHAKER; H. Schwarz, Mannheim. App. filed July 26, 1898. Two pairs of rods are provided within two coils. By self-interruption of the current, these rods oscillate, which oscillation is transmitted to the sieves, etc., by means of bell cranks.

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Voltage,
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Capacity,
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DISCHARGE RATE IN AMPERES.
Normal ½
Safe Max. 1
Recharge Rate,
1½ Amp. for 3½ H'rs.
Weight of Elements, 17¼ oz.
Weight of Cell Complete, 2 lbs. 1 oz.
Height of Battery cell, 5 ins.
Height of Battery cell including binding posts, 6 ins.
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A highly efficient storage battery for open or closed circuit for Telephones, Fire Alarm Signals, Large Annunciators, Small Motors, Small Lamps: Dental, Medical and Laboratory Work, and for sparking Gas and Gasoline Engines, Etc.

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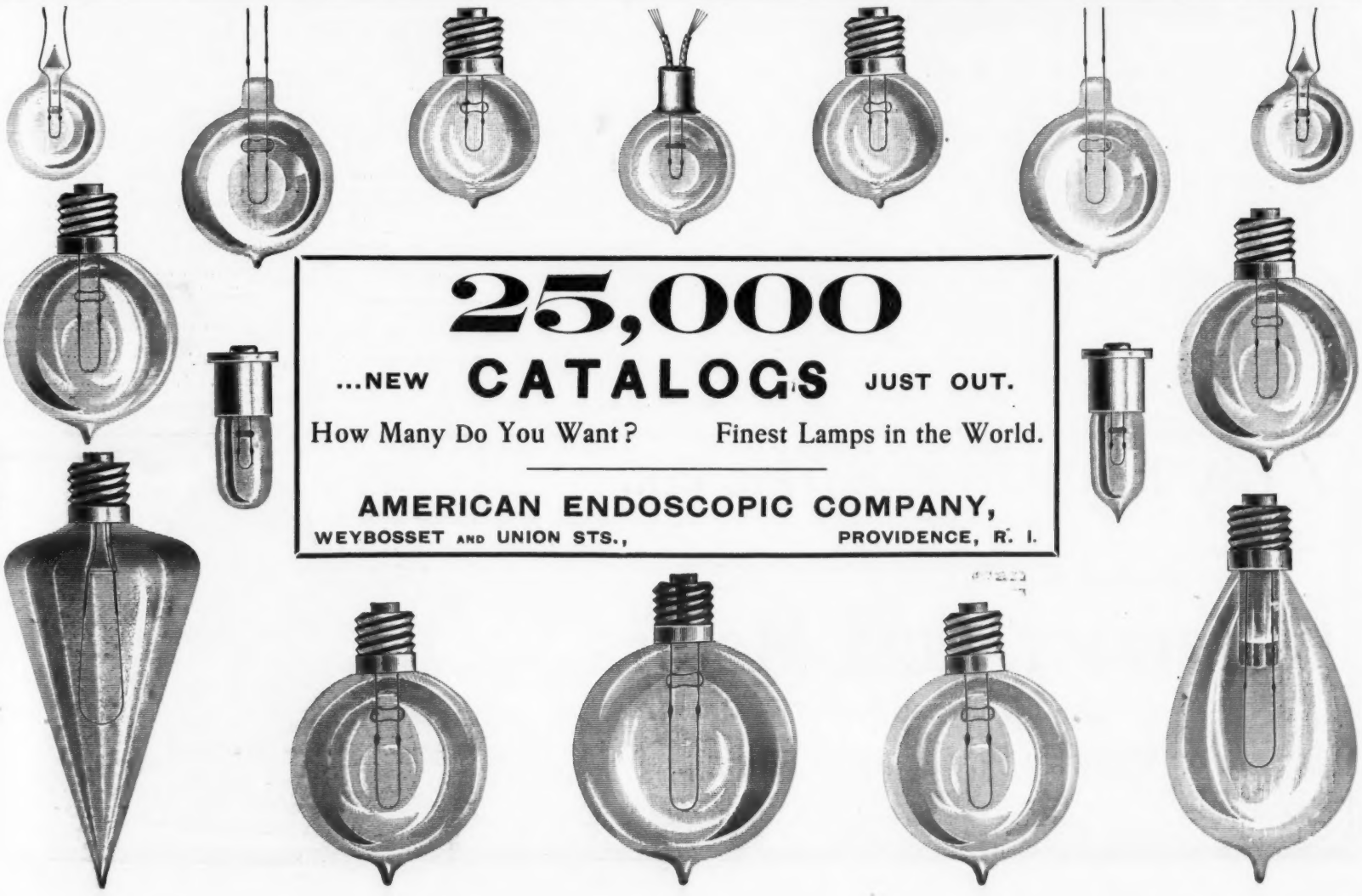

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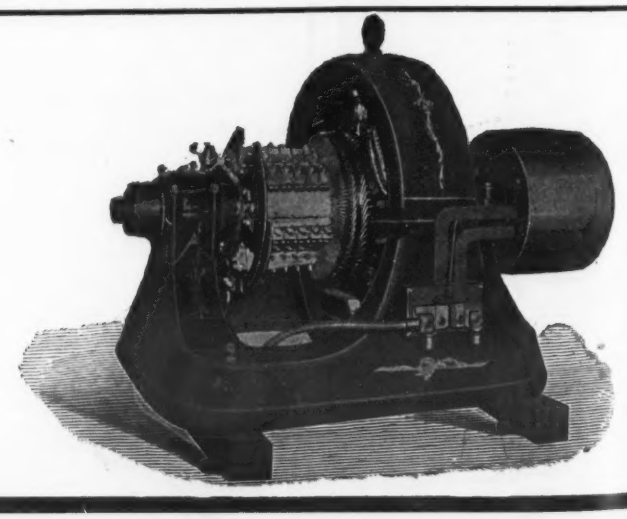

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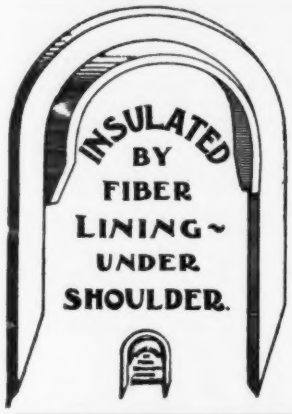

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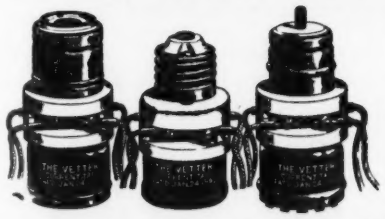

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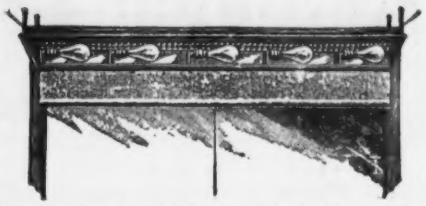

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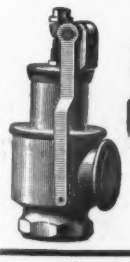

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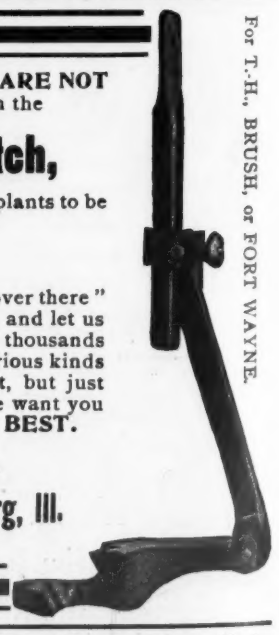

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